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ABSTRACT

This monograph is designed to be used as a complete volume or as a set of papers that can be referenced separately. The monograph is organized into two sections. Section I: "Getting Ready" is designed to help educators get started, plan for, and integrate technology into adult education. The five papers in this section are as follows: "Making Technology Happen in Adult Education" (Christopher E. Hopey); "Planning and Funding for Technology" (Hopey); "Making the Right Choice: Software Evaluation" (Hopey); "Integrating Technology into Adult Learning" (Lynda Ginsburg); and "Recommendations for Using Technology in Adult Education" (Hopey). Section II: "Moving Forward," contains six papers that address the following topics: "Adult Learning Theory: An Argument for Technology" (Regie Stites); "Technology in Adult Education Programs" (Terilyn C. Turner); "Using Technology for Assessment in Adult Learning" (John P. Sabatini); "Distance Learning and Adult Basic Education" (John Fleischman); "The Internet and Adult Educators" (David Rosen); and "Adult Learning, Technology, and Public Policy" (Mary Lovell). The monograph contains a list of 12 national adult education agencies, including their website addresses, and 85 references. (SK)

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edited by
Christopher E.
Hopey

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Technology, Basic Skills, and Adult Education:

Getting Ready and Moving Forward

Information Series No. 372

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Foreword

The Educational Resources Information Center Clearinghouse on Adult, Career, and Vocational Education (ERIC/ACVE) is 1 of 16 clearinghouses in a national information system that is funded by the Office of Educational Research and Improvement (OERI), U.S. Department of Education. This paper was developed to fulfill one of the functions of the clearinghouse—interpreting the literature in the ERIC database. This paper should be of interest to adult educators and program administrators, especially in adult literacy and basic education.

ERIC/ACVE would like to thank Christopher E. Hopey, Associate Director of the National Center on Adult Literacy (NCAL), Graduate School of Education, University of Pennsylvania, who edited the paper, and the chapter authors: Lynda Ginsburg, Senior Researcher, NCAL; Terilyn C. Turner, Director of Community Education, Saint Paul Public Schools, Minnesota; Regie Stites, Education Research Scientist, SRI International; John P. Sabatini, Senior Researcher, NCAL; John Fleischman, Director of the Outreach and Technical Assistance Network, Sacramento County Office of Education; David Rosen, Director of the Adult Literacy Resource Institute, Boston; and Mary Lovell, Technology Specialist and Administrator, Office of Vocational and Adult Education, U.S. Department of Education.

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Training for Employment

Executive Summary

This monograph is designed to be used as a complete volume or as a set of papers that can be referenced separately. The monograph is organized into two sections. **Section I: Getting Ready**, is designed to help educators get started, plan for, and integrate technology into adult education. The five papers in this section present the case for using technology in adult education, outline initial steps, present a technology planning process and sources of funding, offer guidelines for software and hardware selection, and suggest a number of approaches for integrating technology with instruction.

Section II: Moving Forward, contains six papers that address the following topics: the interconnections between adult learning theory and educational technology, programmatic uses of technology in adult education; computerized adaptive testing and the outcomes of SARA (Study of Adult Reading Acquisition); examples of adult learning at a distance; results of a survey of adult literacy practitioners on Internet use; and an overview of policy issues and federally supported programs using technology in adult education.

Throughout the paper, the authors provide suggestions and recommendations for making the best uses of technology and providing staff development. The monograph contains a list of national adult education agencies, including their website addresses, and 85 references.

Information on the topics in this paper may be found in the ERIC database using the following descriptors: *Adult Basic Education, *Adult Education, *Adult Educators, Adult Learning, Computer Software Evaluation, *Computer Uses in Education, Distance Education, Educational Finance, Educational Planning, *Educational Technology, Internet, Public Policy, and Staff Development. Asterisks indicate descriptors that are particularly relevant.

I think there is a world market, for maybe five computers.

Thomas Watson, chairman of IBM, 1943

Television won't be able to hold on to any market it captures after six months. People will soon get tired of staring at a plywood box every night.

Darryl F. Zanuck, head of 20th century Fox, 1946

There is no reason anyone would want a computer in their home.

Ken Olsen, president of Digital Equipment Corporation, 1977

SECTION I:
Getting Ready

Making Technology Happen in Adult Education

Christopher E. Hopey

The Challenge for Adult Education

For more than a decade adult education has been beset by relatively constant scrutiny, criticism, and calls for accountability and reform. The perceived shortcomings of adult education programs are only exacerbated by the fact a majority of the 24 percent of adults who are considered functionally illiterate will never enroll in a traditional adult education program. Those who do enroll in programs tend to participate for only short periods of time and drop out after an average of 50 hours of instruction. Obviously, traditional adult education programs, many beset by inadequate facilities, funding constraints, and complex staffing patterns, are not meeting the needs of a significant number of adult learners (U.S. Congress 1993).

What can be done to improve this situation? Some adult educators are responding to this challenge by developing technology-based learning programs. By coupling a variety of technologies with new modalities of instruction, adult educators are now providing adults with another chance at a basic education, reaching those disadvantaged by limited time, distance, or ability to persist. A few notable adult educators are currently experimenting with instructional television, portable computers, and Internet-based learning. Among the notable programs are the Ronald Hubbs Adult Education Center in Saint Paul, Minnesota; Piedmont Community College in North Carolina; and the Brooklyn Public Library in Brooklyn, New York. The commonality among these programs is that they have overcome many of the barriers that are inherent to the field of adult literacy, such as the lack of financial support, reliance on volunteers and part-time employees, and the patchwork nature of the adult literacy service delivery system. They are using technology not as an "add-on" but as a friendly set of instructional tools that allow for greater privacy, control, individualization, feedback, and flexibility (Anderson 1991; Askov and Clark 1991; Turner 1988a, 1988b, 1993).

The Case for Using Technology in Adult Education

Using technology to address problems, improve instruction, and raise the quality of adult learning opportunities will take more than simply increasing the supply of hardware, software, and telecommunications equipment. The hard questions have less to do with the quantity and availability of technology than with the quality and effectiveness of technology use.

When used well, technology can be a powerful tool for expanding learning opportunities across the lifespan. The potential for technology to expand and improve learning by adults is especially great. Despite this, technology is not a magic bullet. However, an analysis of the literature and an inventory of the experiences of teachers and learners who use educational technology confirm that the use of educational technology for adult learning can have a number of positive impacts on educational processes, outcomes, and achievement. Stites, Hopey, and Ginsburg (1998) believe that educational technology can—

- **Improve both educational attainment and skill acquisition**. Adults who use educational technology can acquire greater knowledge and develop active learning skills, problem-solving skills, and critical thinking skills.

- **Bridge the gap between educational disparities of race, income, and region**. The capacity of networking technologies to open channels of communication and to provide access to information resources for marginalized communities and individuals is a major benefit.

- **Contribute to accountability**. Using technology in adult learning can reinforce learner-centered instruction and outcomes-based education and improve the relationship between teaching, learning, assessment, and effectiveness.

- **Provide a relevant and appropriate context for adult learning**. Most adults have experienced a lifetime of learning. In some ways, this experience is a tremendous advantage and in other ways it may be a burden. Adults have little time to waste on learning that does not result in clearly apparent benefits.

Technology for adult learning can assist with instruction that is appropriate to the age and life situations of adult learners. Learning tasks with technology can be rooted in the lived experience of adult learners.

- **Accommodate learning differences**. Technology can accommodate learning differences so that instruction is available in a variety of modes suited to a range of learning styles and preferences.
- **Motivate and sustain adult learning**. Given the noncompulsory nature of adult learning, it is critically important that learning tasks not only be challenging but also rewarding. Adults are motivated to learn when they can see that the time and effort devoted to learning will pay off. Adult learners have a wide range of learning goals, and they are not likely to waste time on learning tasks that are not clearly leading to the achievement of their goals. Technology can be rewarding if used in such a way that it enables adult learners to meet information and learning needs as they arise in the course of daily life and work. Technology can make adult learning more robust and provide learners with tools that function effectively and reliably in a variety of adult life and work contexts.
- **Provide greater access to adult learning**. The recent trend toward the development of convergent technology (merging of computer and telecommunications technologies) has great potential for facilitating daily access to adult learning. Access to video learning materials through broadcast, videotape, and online is just one example of this trend in technology toward multiple channels of access and interoperability.
- **Empower adult learners**. Technology can support learning processes that are transformative, enabling and empowering adult learners to become more critically aware and to pursue individual and collective interests.
- **Facilitate institutional change**. Technology, especially communication technologies, can be used to create spaces for questioning existing policies, practices, and attitudes. Technology can support the flow of ideas and provide new avenues for reflection and review that are critical to improving teaching and learning.

- **Redefine relationships and roles**. Technology can promote new ways of teaching and learning. Technology can redefine the relationship between learners and teachers so that instruction has more authentic social interaction, critical reflection, dialogue, and creative action.

- **Reconcile the gaps between learning in the workplace and learning in school**. Technology has played a major role in bringing "real world" learning experiences into classroom settings. By the same token, technology has also made it possible to extend learning opportunities once available only in the classroom into the world beyond the school.

Getting Started with Technology in Adult Education

Step 1: Think through What You Want

For many adult educators, using technology for instructional purposes is a painful and confusing process. The terminology is alien, the prices are often high, the materials and content available are usually far too limited, and implementation is often hindered by fiscal or programmatic obstacles.

As in other areas of adult education, the key to making good technology decisions is to have a firm grasp of what you wish to accomplish using technology. All too frequently, adult education organizations fail to consider thoroughly their educational goals and/or the needs of their student populations before using technology.

Technology implementation and use are much easier once adult education programs have determined a broad set of goals and objectives for their students and instructors. In the early stages of using technology the emphasis is on access and information. As educators gain experience and knowledge, the emphasis focuses more on how to accomplish specific goals and what technology products, resources, or materials are available to help achieve these goals. As expertise is developed, a cultural change takes place that questions existing instructional policies, philosophies, curricula, and infrastructures. Gradually, as the cultural change takes hold, new ways of thinking about adult education emerge.

Step 2: General Considerations before Beginning down the Technology Path

The successful integration of technology into adult education depends on six general considerations that are integral to the process of technology implementation:

- **Planning**. Educational technologies encompass a family of interrelated hardware, software, and knowledge. This suggests the need for a blueprint or plan for using technology. Technology planning is a must for implementing technology.

- **Training**. The adoption and implementation of technology is not simple; in fact it can be very complex—so much so that there is a high demand that users acquire new skills and knowledge for using the technology. This implies that training needs to part of any technology implementation process. Technology training is a requirement if teachers and learners are to maximize the potential of educational technology.

- **Technical Support**. Technology is not self-maintaining. It doesn't always work the way it is supposed to. Teachers and learners require technical support, both to maintain the technology, and to maximize its inherent advantages over other, less sophisticated educational tools.

- **Organizational Transformation**. Technology means more than hardware and software. Technology creates both opportunities to improve and change educational practices while also creating new challenges and obstacles. Technology does change organizations. Many organizations adopt strategies to manage and guide the changes in a proper and positive direction.

- **Leadership**. Most successful technology implementation processes need champions who will guide others. Although leadership should come from organizational leaders, many teachers can also be champions and provide informal leadership.

- **Resources**. Educational technologies cost money. They require time for implementing and they will not be self-supporting. This implies that organizations need to rethink how they allocate resources and spend their time.

Step 3: What about the Internet?

The Internet has become both a major opportunity and a headache for adult education programs. The Internet is a network of tens of thousands of computers that use special software to communicate with one another through modems and phone lines or through direct wire connections. Messages traveling between computers on the Internet can take a variety of paths. Users on one Internet-connected computer are able to access services and information located on other Internet-connected computers by using special software programs. Some of the more popular Internet programs include electronic mail (e-mail), the World Wide Web (WWW), and File Transfer Protocol (FTP). The number of people using the Internet is growing rapidly. It is expected that by the year 2000 more than 100 million people across the globe will have an Internet account. However, the Internet is not all that easy to use and it requires learners and teachers to be engaged.

The World Wide Web is now one of the most popular uses of Internet technology in education. The Web is an excellent method for viewing information on the Internet. The Web organizes text, graphics, video, and audio together into page-like documents that are viewed with a single software tool called a browser. The notable feature of the World Wide Web is its interlinking of page-like documents that enables a person using a browser to go among and across a series of pages by simply selecting a highlighted word or graphic called a "link." Links act as items in a table of contents. When a user clicks on a linked word or graphic that is of interest, the browser displays a new page that represents the "link."

The Internet isn't going away, and it is the fastest-growing technology yet known. Ignoring it would be a major mistake, because it is poised to be the technology that most adult educators and adult learners will turn to first. Most of its content is very rich and for the most part free, a notable advantage for the adult education community.

Step 4: Take a Long-Term View of Technology

Getting started should be relatively straightforward as long as program goals and student needs are clearly articulated. Making good technology decisions means planning for technology. However, the first thing to realize about planning for and implementing technology is that there is never a perfect time to buy. Inevitably, a new, improved, and less expensive piece of hardware or software will be released within weeks of your purchase. It is also inevitable that large manufacturers will announce new products that are supposed to "revolutionize" computing and then delay the actual release of the product for months.

Finally, things don't happen overnight. The process of technology implementation can be anxiety ridden due to the belief that a specialized body of knowledge is required (Turner 1993). However, technology changes so rapidly and there are so many models and types available that no one can be certain of having all the information. Choices and decision-making risks are minimized by establishing goals, being patient, previewing products, involving staff and students in the decision-making process, and using some basic common sense.

Planning and Funding for Technology

Christopher E. Hopey

Planning for technology is increasingly becoming a priority among adult literacy programs. Although some adult literacy organizations engage in planning activities, few have extended those activities to technology (Hopey and Harvey-Morgan 1995b).

Technology planning can assist literacy organizations with the decision-making process by establishing standards, norms, and methods for evaluating, purchasing, implementing, and using technology. Furthermore, technology planning can help adult literacy organizations identify program and technology priorities and match those priorities with organizational, human, and financial resources.

Planning is an ongoing process that translates program and technology needs into concrete actions. It allows adult literacy organizations to take advantage of technology innovations while minimizing the negative impact of unexpected challenges. Planning provides a road map for the implementation of technology and can result in more efficient expenditure of limited resources.

The Basic Principles of Planning for Technology

A few basic principles should drive the technology planning process. These principles are based in part on a model developed by Shirley (1988). Technology planning for adult learning should—

- be an organized and continuous process, use a simple straightforward planning model, and result in a document that improves how technology is used for instruction, management, assessment, and communications;

- take into account the mission and philosophy of the adult literacy organization and be "owned" by that organization, its administrators, and instructors (although outside assistance, such as that provided by a consultant, can bring a broad perspective and knowledgeable opinions to the technology planning process, the process must have the commitment of program staff);

- be broad but realistic in scope, with economical and technically feasible solutions;

- involve all the stakeholders, including administrators, instructors, staff members, students, and technology experts with experience in education;

- identify the strengths and weaknesses of the organization and how each will affect the implementation of technology;

- formalize the procedures and methods for making technology decisions, including the setting of priorities, purchase, evaluation, upgrading, and use of technology; and

- be driven by educational goals and objectives rather than by technological developments.

Have a Plan to Do Technology Planning

Before undertaking technology planning, it is important to have the commitment and support of the institutional leaders, staff, and instructors. The best way to achieve this is to do some simple preplanning to encourage participation in the process and to minimize later setbacks. An effective technology planning process should be consciously and formally organized, since preplanning involves the right people at the right time. The following set of suggested activities can help literacy organizations get started with technology planning:

- Decide who should be involved, what role each person will play in the planning and implementation of technology, and whether a committee or advisory group should be assembled.

- Preview other planning processes that the organization has completed and identify any useful insights for improving this planning process.

- Review the planning processes of other literacy organizations to identify useful material that can serve as a paradigm.

- Identify a lead person or "change agent" who will organize the planning process and make sure everyone involved has adequate input.

- Determine who will be responsible for writing the plan.

- Determine a timeline for completing the plan.

The Technology Planning Process

Step 1: Develop a Vision for Technology in Adult Learning

Technology lends itself well to adult literacy instruction (Massachusetts Software Council, Inc. 1994) because it is a powerful tool that, when properly implemented, improves the delivery of services. However, instructors and staff have little incentive to tackle the technical and scheduling problems associated with technology unless they have a clear idea of how it can improve teaching and learning (Means et al. 1993). Exactly which educational goals a literacy organization should address and attempt to accomplish must be determined before the technology plan is implemented (Holmes and Rawitsch 1993).

Technology should not drive decisions or educational goals. Rather, decision making should be based on the educational needs of adult learners and the needs of staff members. Technology cannot prescribe for an instructor which students should use the technology, how often it should be used, or how to integrate technology into existing instructional practices. Unless staff start out with specific educational goals, technology will most likely be used to reinforce the status quo (Cohen 1988; Cuban 1986). Educational goals and objectives should be developed around student needs and administrative goals around staff needs; technology should be used to help achieve these goals. Such goals could include increased student achievement (i.e., improved reading and writing, greater employability, increased self-confidence, and empowerment), better communication among staff members, and more community involvement (i.e., volunteers, fundraising, etc.).

There is evidence that when educational goals are not decided upon before technology implementation, technology can become a drain on resources and add to the burdens of teachers who are already trying to do too much (Piele 1990). This problem can be avoided by formulating a plan to connect educational goals, values, and objectives to technology use. Once the stakeholders involved understand the educational goals and see how technology will make their lives better, they are likely to become more open to technology planning and implementation.

A vision of how technology might be used should embody the individual program's educational goals and issues. It should reflect what an organization thinks the educational process could be with the broad adoption of technology (Massachusetts Software Council, Inc. 1994). The vision should be creative while at the same time realistic. The ultimate vision of how technology will be applied must reflect the clients served, the resources available, and the commitment and willingness of the staff and students to use technology. A vision is always evolving; changes and adjustments will occur.

Step 2: Investigate the Uses of Technology that Meet Your Vision for Technology

With technological change occurring at a rapid pace, purchasers of new technology sometimes feel hard pressed to keep up (Fine 1991). However, not every type of technology is appropriate for every student or every adult literacy organization. Many technologies require personal and programmatic changes for implementation. Others are relatively easy to implement and use. Before making a technology decision, planners should explore the vast range of technologies available. Since the level of technology use in adult literacy organizations is partially determined by the integration of technology into regular practices and routines, technologies must be selected that users (students and staff) want to use and from which they will benefit.

The range of technology solutions is almost unlimited, so organizations must take the time to analyze each possible solution and look at its advantages and disadvantages in light of the organization's particular educational goals and vision. It is also important to keep in mind that, although many literacy organizations use high-end technologies such as computers and telecommunications, low-end technologies such as VCRs and audiotape players can be used very effectively as well and should be considered for the solutions that they might provide.

The following should be considered when investigating specific opportunities for technology use:

- Identify the advantages and disadvantages of using specific technologies with adult learners and staff. Focus on enhancing regular routines, practices, and activities and solving existing problems.

- Identify what should be changed in the methods of instruction or administrative practice in order to implement the technology solution; determine how the technology solution will be integrated into instructional and administrative activities.

- Determine how students, teachers, staff, and the technology will interact with each other. Forecast how the use of technology will change the relationship between students and teachers and between staff members.

- Determine who will have access to the technology and when.

Step 3: Develop a Technology Budget

Of course, costs are also a consideration when investigating technology. Developing a technology budget focuses attention on the resources necessary to meet the vision for technology. Judgments on resource allocation and trade-off decisions between different types of technology can be made at a planning level before the technology is purchased. This is preferable in order to avoid making costly midstream adjustments when finding that resources do not cover overly optimistic objectives. The following four steps are useful for developing a technology budget:

1. Gather information about the cost of the various hardware components that are needed to operate each of the software packages. Determine the per workstation cost of the hardware (workstation is defined as all of the components of the system).

2. Start a budget worksheet. For each piece of hardware and software, list the price as well as the cost of necessary staff development. The following breakdown provides a useful guide for allocation of resources:

Item	% of Budget
Software	20%
Hardware	60%
Staff Development	10%
Maintenance	5%
Supplies	5%

3. Determine how much money the organization has available to purchase technology within existing budgets. Examine ways in which the organization could reallocate existing dollars to cover some of the technology costs. Analyze how reallocation of existing dollars would affect the organization.

4. Compare fiscal resources available, including reallocated resources, for the proposed technology budget. If there is a shortfall, consider the options for making up the difference.

Step 4: Analyze Technology Staff Development Requirements

When considering the real costs of implementation in terms of time, money, and organizational impact, training instructional staff is a major factor to be addressed. In terms of actual staff development—which differs from staff awareness activities conducted as part of the planning activities—organizations should focus on preparing staff to deliver instruction and use technology for everyday activities. Comprehensive training is essential for two reasons. First, proper training will allow staff to make informed decisions regarding software selection and technology integration. Second, only well-trained, confident staff members can effectively train and support other staff members and use technology effectively with students.

Teachers, administrators, and other personnel must all know how they can use the technology to support their particular responsibilities. Although a broad array of software may be of interest to them, these individuals are typically pressed for time and will initially prefer training that directly supports their particular work. Nonetheless, training must be broad enough to open the minds and imaginations of the users.

Anyone who has participated in a discussion about technology knows that no two people view technology in exactly the same way, learn at exactly the same pace, or develop the same level of interest in technology. Staff trainers and outside consultants are faced with the complex task of designing and facilitating training that covers a core set of topics, but is flexible enough to support each individual staff member. Several models exist for training that is both relevant and cost effective. These include, but are not limited to, the following:

- Workshops that begin with standardized group instruction and then allow time for users to explore on their own, asking questions as they arise;
- One-on-one instruction and small group instruction in which individuals with like skills and/or interests are grouped together;
- Workshops in which participants with varied skills are organized in small groups—the more experienced can serve as mentors or peer coaches for the less experienced; and
- Hands-on tutorials in which staff members can learn at their own pace.

In all of these models, staff members should be encouraged to rely on one another whenever possible. This not only encourages collaboration and communication, but also prepares staff members to assist one another when trainers are not available. Following are some basic guidelines for building an effective technology staff development program:

- Basic technology training should be provided in a sequence that gradually increases in complexity and is sufficiently flexible to allow trainees to begin at their own level of ability and progress at their own rate.
- Training should be designed to allow instructors the opportunity to practice new skills in the course of their regular teaching.
- Training should take place during the work day, make use of actual situations involving students, and provide incentives that motivate staff to participate actively.
- Whenever possible, staff members within the organization should be used as instructors for the training.

- Training should encourage staff to support each other in their use of technology.

Step 5: Devise an Implementation Timeline and Make Revisions

At this stage of the planning process, priorities and objectives are clear, staff development activities have been identified, and the budget is determined. The literacy organization has direction and long-term technology objectives. Because it is an ongoing process, implementation requires the development of a timeline, which should reflect dates and milestones for the achievement of short-term and long-term objectives. For each new technology introduced to an organization, there will be stages within the implementation process that include fundraising, evaluation, selection, installation, training, pilot projects, mini-implementations, and finally, full implementation. These stages should all be reflected in the timeline. It is important that the timeline follow established goals, objectives, and priorities; build in time periods to assess and reassess resources; include time to evaluate the plan; schedule training on an ongoing basis; and include feedback time to keep all stakeholders informed and ready for changes.

Finally, it is important to remember not to judge technology as ineffective when it is not implemented according to the plan (Holmes and Rawitsch 1993). Flexibility, patience, and adaptability are essential for any kind of change process and certainly for implementing technology.

Technology planning is a continuous process that adapts to the organization's changing circumstances and includes ongoing evaluation. Effective evaluation will force planners to rethink and adapt objectives, priorities, and strategies as implementation proceeds. Continuing evaluation also facilitates making changes if aspects of the plan are not working.

An evaluation or review can be conducted by various means. Simple observations, both negative and positive, that have been made by students and staff members using the technology are the most helpful. Interviews and informal meetings with both instructors and students can draw out the lessons that both groups have learned from using the technology. A simple written survey can assist in measuring the extent to which the plan has met its original objectives and expected outcomes.

The following questions should be part of the ongoing evaluation:

- Are the plan's vision, goals, and objectives being achieved? Are they realistic? What evidence exists to support this? Do they need modification?
- What is the current effect of training on implementation? Does training need to be modified?
- What are some of the major problems that have been encountered? How have they been resolved? Have the resolutions improved implementation?
- Is the timeline realistic?

Finally, review the plan periodically to make adjustments. Continue to monitor implementation and always inform, educate, and motivate the stakeholders who are involved.

Step 6: Write the Plan

The technology planning process should include a written plan. Writing the plan will help to solidify the ideas and concepts that have been discussed and debated by the planners. It also provides a document to which others can react, and it can become the basis for effective technology fundraising endeavors. Writing the plan should begin at the start of the planning process. The plan will gradually evolve into a formal written document as the process unfolds. The most important criterion for writing a plan is not its length but its substance. Also remember, the writing of the document should be organized and edited by one or two people but the planning discussions that guide the writing process should include as many people as possible. The planning document is a shared vision of many people; input and multiple revisions to the written document should be expected.

Connecting Technology Planning with Funding

A technology plan serves as a blueprint for technology use and helps set technology priorities and goals in order to focus fundraising activities. It not only creates a source of ideas for grant proposals, but also demonstrates a commitment to the use of technology, giving funders a degree of confidence in their investment.

With a carefully considered technology plan, the process of technology fund-raising is straightforward. The following five principles should be used as a guide for literacy organizations who are raising funds for educational technology:

1. *Develop a technology funding profile that identifies the priorities of the technology plan.* The priorities should be categorized according to those that can be funded with existing dollars and those that will need additional funding.

2. *Do not try to fund an entire technology plan with one funder or funding method.* Funders want a clear understanding of what they are being asked to support; make each funding request specific, concise, and manageable. Do not ask for too much in a single proposal to one funder.

3. *Emphasize the organization's technology accomplishments and build on past technology successes.* The process of obtaining technology should be gradual and deliberate. Literacy organizations should be realistic about what they need and what they can use. Funding should be sought to enhance the program, not just to purchase the newest gadgets.

4. *When asking for financial support, educate the potential funder about the advantages and importance of technology in adult literacy.* Frame the use of technology as innovative and crucial for enhancing the teaching and learning processes. Emphasize the lasting impact that the incorporation of technology will have on the literacy organization and the adults that it serves.

5. *Include technology in all grant-writing and fundraising activities, even when they are not technology specific.* When possible, technology acquisition should be incorporated into the regular grant-writing process and should not rely on special circumstances.

Funding Sources for Technology

Fundraising is a long but rewarding process that requires organizations to have both patience and persistence—patience to wait for funders to approve a grant and persistence to seek funding from a diversity of funders. Funders may be multibillion dollar private foundations or local community groups and individuals, and each has a mission and a goal for its philanthropic giving. Categories of funders of technology in adult literacy include—

- **Foundations**—There are more than 37,000 foundations in the United States (Foundation Center 1994).

- **Corporations**—Through corporate giving programs, some corporations make grants on behalf of individual contributors. Some corporations also donate older computers to adult literacy organizations. Donated computers are a growing source of technology in adult literacy.

- **Local Community Agencies**—Organizations such as the United Way, Elks Lodge, and VFW Posts supply small amounts of funding for technology.

- **Federal Government**—The federal government is the largest funder of educational technology in the United States; however, almost all the funding goes to K-12 education. Literacy organizations should seek collaborative partnerships with other sectors of education to gain access to additional federal funding sources for educational technology.

- **State Education Agencies**—Some state education agencies allow literacy organizations to fund technology through an equipment budget line item under their state adult basic education grants.

Methods for Funding Technology

Grant-writing is the most common method of funding technology, but other methods can be just as effective and are often overlooked. Outlined here are five basic methods for funding technology in adult literacy organizations:

1. *Requests for Proposals (RFPs)*. These are most often announced by public funding sources and occasionally by private sources. One of the most common and popular methods, they require formal, written proposals based on a set of regulations that define the scope of work that the grantee is to undertake. These grants are usually very competitive and require considerable paperwork. In many cases, an RFP may not mention technology as a priority, but technology can be included as equipment in the budget.

2. *Unsolicited Proposals*. Many funders, most often private sources, do not have specific funding guidelines or time frames and receive unsolicited proposals. However, an unsolicited proposal should be based upon some knowledge that the funder will be

open to the idea of funding technology for a particular organization. Most unsolicited proposals are directed toward private or community foundations; corporations; community, civic, religious, or quasi-public groups; or private individuals. Most of the grants made by these groups are local in nature, and many can be negotiated through a brief letter/proposal that describes the technology project, its objectives, and expected outcomes; how it fits into a program's overall technology plan; and a basic line-item budget.

3. *Equipment Donations*. Corporations, community and civic groups, and individuals may donate a new or used computer or a piece of software. It is important to make these organizations and individuals aware of specific technology needs because they may have older computers that they are planning to throw away. Not only can adult literacy programs benefit from such donations, but private individuals and companies may be able to benefit from a tax deduction as well. A telephone call, personal communication with a friend or board member who works for a corporation or belongs to a group, or a simple letter is usually the most effective way of communicating technology needs.

4. *In-kind Services*. Technology funding is not only for equipment. Computers require maintenance and set-up, staff members need training, and administrators need help in technology planning and fundraising. Look for individuals who are willing to donate their time to help with technology. If asked, the technology staff members of many corporations and colleges may be willing to donate some of their time.

5. *Fundraising Events*. A technology fund-raising event can often elicit individual donations. Fundraising events do not have to be extravagant. Whether the event is a telephone campaign, fund-raising dinner, book signing, raffle, or local run-for-fun or walk-a-thon, technology is a tangible commodity in the eyes of people who donate small sums of money. A simple raffle to buy a new computer can be effective. Keep in mind that fundraising events take time to plan and implement and usually require the help of many volunteers to be successful.

Conclusion

It is apparent that participation in a systematic planning process can help adult literacy programs, organizations, and consortia to capitalize on the opportunities available through the use of technology. Systematic planning—whether simple or complex—can help to maximize the investment of resources in technology.

Several factors should be kept in mind in order to maximize the impact of the technology planning process. Administrative involvement and leadership are crucial to the technology planning and implementation process. If organizational leaders do not understand and support the technology plan, it will be difficult to implement and can be either intentionally or inadvertently sabotaged.

Technology fundraising can be a successful and enjoyable experience for adult literacy organizations as long as they develop a technology planning process and connect that planning process to fundraising activities. Planning involves managing change rather than letting change overwhelm you. Funders' priorities and focuses change, but adult literacy organizations that plan and fund technology with an array of sources will expand their own use of technology and prepare their students for the future.

Finally, the key to technology planning and fundraising for technology is to be patient, persistent, and most of all avoid becoming discouraged. For many literacy organizations, it may take writing a few technology proposals before one is successful. However, with a well-organized technology plan and some basic preplanning and funding research, you should be successful.

Making the Right Choice: Software Evaluation

Christopher E. Hopey

For many adult literacy practitioners, finding, selecting, and evaluating software for instructional purposes is painful. The terminology is alien, the prices are often high, the choices are either far too extensive or far too limited, and buying is often driven by fiscal deadlines or funders' vagaries. Just as in the K-12 system, many multithousand dollar purchases become doorstops or props for other materials stored in a resource cabinet.

The successful integration of technology into adult literacy instruction depends on the careful selection of technology appropriate to each individual adult literacy program. There is no one clearly superior software product, website or piece of hardware—any piece of software can be effective if embedded in an appropriate curriculum and surrounded with support materials (Sorge, Campbell, and Russell 1993). Different populations require different kinds of software.

As in other areas of organizations, the key to making good technology purchasing decisions is to have a firm grasp of what you wish to accomplish using technology and a process for evaluating both hardware and software.

Ideally, adult literacy educators and administrators should attempt to select appropriate software packages before focusing on hardware issues, since the software (not the hardware) dictates educational content. Hardware such as computers is really nothing more than a delivery system for different types of software. One minute the computer can be a word processor, the next a movie screen by changing the software. Computer hardware has no inherent content. Only the software contains useful information that students can use.

Despite this fact, programs often focus on hardware first, letting their hardware determine what software and thus what content their students encounter. No literacy program would let the size or shape of their chalkboard limit their instructional options. Yet when literacy programs focus solely on hardware issues, they are essentially letting the chalkboard dictate the content—they permit the machine's capabilities to dictate software choices, content, and, ultimately, educational goals.

The Software Evaluation Process

Step 1: Identify Software Titles

Selecting software begins by compiling a list of potential software packages (Beattie and Preston 1989). Sivin-Kachala and Bialo (1992) have identified more than 1,400 adult literacy instructional software programs in reading, writing, math, and career guidance. It is impossible for any program to review comprehensively every piece of available software, even in a subarea such as English as a second language (ESL) or General Educational Development (GED) preparation. It is best to reduce the number of software packages available to 4-10, those that are likely to fit the program's educational goals and objectives.

This step is primarily an information-gathering process. The choice of who will carry out this step is an important consideration, as this person will influence which pieces of software are evaluated throughout the rest of the software selection process.

Once the person or persons who will be responsible for gathering information on software options are identified, it is necessary to identify information resources. Literacy providers have often commented on the lack of resources regarding software appropriate for adult literacy learners. Recently, state and federal agencies have invested in the creation of information resources on adult literacy software, though none are complete or always current. A few recommended sources of information are—

1. *Software Guides*. Many software guides are published and updated annually. Most are not adult literacy specific, but they may still include a few relevant software titles.

2. *Software Companies and Sales Representatives.* Many sales representatives can provide timely information about products and options. In order to use vendor representatives effectively, you must know how to ask questions that move the representative beyond the standard sales pitch. This requires homework, which too few purchasers do before contacting a vendor.

3. *Software Reviews.* Many magazines, journals, and trade publications publish software reviews; these publications may be found in local libraries or requested from hardware and software vendors.

4. *Software Catalogs.* A number of companies serve as clearinghouses for educational software, including adult literacy software. These clearinghouses and large distributors usually publish catalogs that contain listings for several software companies.

5. *Internet Resources.* Some software companies make software demonstration copies available on the Internet. You can also find software reviews in databases and online magazines.

6. *Other Literacy Programs.* Other literacy programs may be the best resource at your disposal. Most adult literacy organizations are willing to share their software lists with other literacy providers, and such lists are frequently the most valuable information available. You may want to contact several literacy providers who serve clients similar to yours, find out what software they are using, and then cross-reference the lists. The products that appear on two or more lists are probably worth reviewing.

7. *U.S. Department of Education, Office of Vocational and Adult Education.* The Clearinghouse on Adult Education and Literacy provides a current listing of software companies and how to contact them.

Although software packages vary, many are categorized by vendors and reviewers according to content areas (reading, writing, math, etc.), instructional levels (ESL, GED, ABE, and A.B.E+), formats (drill and practice, tutorial, simulation, etc.), and price. When looking for a software package, it is best to begin the search by content area, followed by instructional level and price.

This information-gathering process should not be a one-time affair. Ideally, instructors, administrators, and students should be constantly looking for new software packages. You should save information about these discoveries in a database or common folder so that you can easily access and consider them the next time you review potential software options.

After gathering information about software options from several sources, you will need to create a set of criteria to determine a package's eligibility for the next steps. These criteria will vary from program to program, but a few basics should always be considered:

- Are other adult education providers using the software?
- Will this package require an investment of time and money that the program could not possibly support?
- Does this software replicate the functions of other packages that the program already owns and finds useful?
- Are there other packages on the market that use a clearly superior design, educational methodology, and so forth?

Depending on the nature of the program, a committee or individual can make the final decision. Though informal, this step is crucial because it determines which software packages are reviewed in later steps. However, it is important to respect multiple perspectives—those of students, instructors, administrators, and (if you are so blessed) lab technicians and support people. One way to start the process of soliciting different points of view is to involve representatives of those groups in this first step.

Step 2: Obtain Software Preview Copies

The best evaluative information comes from a firsthand examination of a software package (Beattie and Preston 1989); therefore, the next step is to obtain preview copies of candidate software. Many vendors and dealers have a 30-day preview policy, which allows potential customers to review the actual software packages before they purchase a copy. Although a few software companies are reluctant to give out preview copies, many vendors offer at least a demonstration copy (i.e., a copy of the software that either does not have all the features of the purchase version, will work for only a specified period of time, or contains only "slides" showing what the full version looks like).

If the vendor offers only a demonstration copy, then it is recommend that you contact and/or visit sites where the software is installed. In either case, you need to talk to other users of the candidate software package. Most sales representatives will supply the names and phone numbers of customers. It is also important when talking to other customers to identify similar programs for comparison; ideally, a correctional facility should talk to staff at another correctional facility about the same product.

One general word of warning: Never purchase on the basis of a vendor demonstration alone (Turner 1993). Demonstration software cannot provide the in-depth information needed for a major purchasing decision. If you can get only a demonstration copy, talk to the vendor again or go to a software demonstration center to preview the candidate package. Many vendors will also point you to a local demonstration center that lends preview copies for short periods of time or has computers with the software installed for in-depth previews. Demonstration centers are usually located at universities, community colleges and sometimes at school districts, state agencies, or state literacy resources centers (SLRCs).

Step 3: Organize Software Evaluation Criteria and Assess Packages

Once you have obtained preview copies, you should thoroughly evaluate and test the candidate software packages to assess their quality and appropriateness. It is wise to involve as many people as possible (especially students and teachers) in this evaluative process. Experience suggests that students' and instructors' perspectives on the value and usefulness of a piece of software are very important.

The first step is to determine evaluation criteria that everyone in your organization is comfortable using. There is no one set of "correct" evaluation criteria. Each program needs to create a set of criteria that are commensurate with its technology plan and the educational goals and objectives established in that plan. The questions listed here suggest a few issues that need to be addressed in an evaluation process. This list is not prescriptive, however; only you can decide which ones belong in your program's process.

The software evaluation process usually begins with a cursory review of the candidate software (Anderson 1991; Turner 1993). Consider the following issues:

- Is the product appropriate for the student population?
- Is the content appropriate for the adult learner?

- How much computer experience would a student need to operate the program?
- Are screen displays easy to understand, informative and uncluttered?
- Can students easily enter and exit the software program?

After the initial review, consider testing the software with students. Student previews can generate important information about the quality and effectiveness of a software package (Beattie and Preston 1989). It is recommended that you allow two or more students to use the candidate software for at least 1 hour and test it. Such tests should be as realistic as possible—if the software is to be used in a lab while others are working, the test should be held in an actively used lab. Sivin-Kachala and Bialo (1992) suggest that teachers observe students testing the candidate software and focus on the following questions:

- Is the candidate software easy for students to use?
- Can students proceed without confusion or frustration?
- Do students seem motivated by the candidate software package?
- How much did the instructor/lab manager need to intervene in order for students to use the package successfully?

Student testing should end with a more summative but informal evaluation. A student summative evaluation should not typically address the issue of learning outcomes but instead should focus on students' reactions to and feelings about the program. Student summative evaluations should answer the following questions (Harvey-Morgan, Hopey, and Rethemeyer 1994):

- Do you think this program helped improve your skills?
- What did you like most about using this program?
- What did you like least about this program?
- How do you feel about using a computer for learning new skills?
- Would you recommend using this program to a friend?

- Do you think this program is too hard, too easy, or just right?

- Do you have any suggestions about how we could make this program better?

Finally, you should conclude the software evaluation process with a more in-depth evaluation of the software. At this point, administrators and teachers should construct a software evaluation instrument appropriate to their needs. Evaluation instruments vary greatly and are available from many different sources. The criteria will vary according to software instructional types, the needs of students, teachers, and the program. It is recommended that you use these as models, but not as ready-to-use instruments, for they are not tailored to any given adult education program or context. The best instrument will be the one you design in cooperation with your own instructors and students. The following areas should be considered as you develop evaluation criteria:

- **Content Questions**. Content questions relate to instructional objectives, appropriateness and accuracy of materials, exercises, graphics, and situations relevant to adult learners (Anderson 1991; Askov and Clark 1991; Bender 1987; Gonce-Winder and Walbesser 1987; Harvey-Morgan et al. 1994; Schueckler and Shuell 1989; Sorge et al. 1993; Turner 1988a, 1988b, 1993; U.S. Congress 1988). See Table 1 for examples of content evaluation questions.

- **Instructional Questions**. Instructional questions should relate to the curriculum and the assessment of student performance, and they should adhere to sound educational techniques and theories (Anderson 1991; Askov and Clark 1991; Bender 1987; Gonce-Winder and Walbesser 1987; Harvey-Morgan et al. 1994; Miller-Parker 1993; Schueckler and Shuell 1989; Sorge et al. 1993; Turner 1988a, 1988b, 1993; U.S. Congress 1988). See Table 1 for examples of instructional evaluation questions.

- **Operation and Design Questions**. Operation and design questions refer to the ease of operation, the level of user control, and the use of multimedia (sound, graphics, and digitized video) (Anderson 1991; Bender 1987; Gonce-Winder and Walbesser 1987; Harvey-Morgan et al. 1994; Schueckler and Shuell 1989; Sorge et al. 1993; U.S. Congress 1988). See Table 1 for examples of operation and design evaluation questions.

Table 1
Questions to Guide Evaluation Criteria

Content Questions	Instructional Questions	Operation and Design Questions
1. Is the content relevant to adults?	1. Is the instruction organized from general to specific?	1. Is the software easy to operate?
2. Are the exercises appropriate?	2. Are there enough explanatory exercises and examples?	2. Are the options, menus, and choices readily available?
3. Is the exercise frequency adequate?	3. Do visual cues clarify major concepts?	3. Can the learner control the display time?
4. Are directions clear?	4. Are there different learning opportunities for different ability levels?	4. Are mouse exercise directions adequate?
5. Is the feedback helpful?	5. Do the graphics, photos, and/or video enhance the instruction?	5. Is it possible to move easily within the software?
6. Does the program provide a final evaluation of the learner's performance?	6. Does the program provide a pretest? If so, what test?	6. Are the program exits obvious at all times?
7. Is the type and placement of requested response clear?	7. Does the program provide a posttest? If so, what test?	7. Is the screen layout pleasing?
	8. Are the tests easy to administer and score?	8. Are instructions provided in areas separate from text?
	9. Can the instructor easily assess student assessment data?	9. Is color used effectively?
	10. Can students easily access their own assessment data?	10. Do the mouse exercises require dexterity appropriate to students' ability?
	11. Does the program adequately assess and evaluate student progress?	11. Do the screens contain an amount of text appropriate to students' reading ability?
		12. Is the reading level appropriate?
		13. Does the software teach important reading comprehension skills?
		14. Are procedures for enrolling new students clear and easy?
		15. Is student progress easily tracked?
		16. Is student progress slowed by unnecessary multimedia effects?
		17. Can students choose to access audio and visuals on an as-needed basis?
		18. Is audio used appropriately, given students' reading level?

Software evaluation is a process of consensus; students and teachers will more readily use software that they have helped to select. By taking into account student evaluations and conducting in-depth software evaluations, you will better see the instructional potential of particular candidate software packages.

Step 4: Determine How Students Will Use the Software and How Teachers Can Integrate the Software into Instruction

At this point, take some time to envision how your students and instructors would actually use the candidate software packages. Adult education programs often buy software that they think only a few students will use, only to discover that their instructors want all their students to use it. For each package, determine how many computers you need in order to use the software effectively. Then ask the questions that Turner (1993) recommends:

- How does the technology purchased fit into the curriculum design?
- Will you add the technology to an existing curriculum or will the technology curriculum subsume present instruction?
- Who will attend to the integration (of technology) and curriculum design?

Turner (1993) argues that integrating new technology into an existing program brings unique challenges. Although integrating technology into the K-12 curriculum is the subject of numerous books and articles, the knowledge base in adult literacy is smaller. Although the issues are similar to K-12, they are not identical. Often a formal curriculum does not exist in adult literacy programs, and technology presents an opportunity to provide more flexibility and learner control (Turner 1993). In other instances and depending upon the teacher and philosophy espoused by a literacy program, the degree to which a standardized curriculum and technology can be integrated is a major question to ask vendors and other literacy programs that use the candidate software packages.

A second crucial concern is the level of staff expertise in and comfort with technology. Although integrating technology into the curriculum requires a consensus among literacy providers about the role that technology will play, many teachers are simply not comfortable using computers. Many instructors feel intimidated by computers and have never considered how they could be used effectively. Again, the need for a good technology plan is apparent. Technology planning will help determine what training is needed and what types of technology expertise must be acquired.

At this point, you should be able to develop a "bottom-line" estimate for each candidate package. The bottom-line estimate should include the cost of the software and extra hardware, if required, for all of the student stations.

Step 5: Hardware Considerations

At this point it is time to examine what type of hardware is needed to run the candidate software programs. The first place to begin the evaluation of hardware is with the software/computer operating system and its compatibility with the software you want to use. It is also necessary to know your computer's type of microprocessor and the amount of computer memory needed to run the software program. Most adult education software requires at least 8 megabytes of RAM (random-access memory) to operate; many multimedia packages require 16 or more megabytes of RAM. At this point you will also need to determine how much hard disk space is required to install the program. Hard disk storage space is also measured in megabytes, so it is easy to confuse hard disk storage requirements and memory requirements.

The second most important evaluation unit in a computer system is the monitor. Monitors, like televisions, are available in a number of sizes. They also have a variety of standards with the most common being SVGA (super video graphics adapter) and VGA (video graphics array), most software manufacturers will state on the package "requires SVGA or VGA graphics," or something to that effect. Most software can be run on a monitor that is at least 13 inches diagonally, though some multimedia programs require 15-, 17-, or 21-inch screens. Monitors also come in different resolutions. Resolution refers to the number of dots (usually known as pixels) displayed horizontally and vertically across the screen. Many programs require that the monitor be able to display a certain number of horizontal and vertical pixels. Most programs will work on a monitor capable of displaying 640 x 480 pixels, though some programs require a resolution of 800 x 600 pixels or 1024 x 768 pixels. Some monitors can display differing resolutions, depending on the capabilities of the computer.

Software developers also use digitized audio to enhance their products. For PC-compatible computers, it is usually necessary to install a "sound board" in one of the expansion slots. Be sure to note which type of sound board the software publisher recommends. The most commonly used sound board in the PC-compatible world is the SoundBlaster™ line from Creative Labs.

Some programs also require the ability to store and manipulate sounds on the computer. For instance, some ESL software packages allow the user to speak into a microphone and then play back what was just said. Be sure to note whether sound input (microphone) is necessary.

Finally, a wide range of devices can be attached to the computer to enhance or extend its capabilities; these are called peripherals. The most widely used peripheral, besides printers, is the CD-ROM drive. CD-ROMs are used to store multimedia software. Many of the newest and best software programs can be run only on a CD-ROM drive. Other peripherals include modems for connecting to the Internet, writing tablets, and optical scanners.

Step 6: Complete the Software Evaluation Process

Having completed the previous steps, you are now ready to choose a software package. Since the majority of the work has already been accomplished, choosing a software package at this point requires only making comparisons between candidate packages, hardware requirements, and educational objectives. This necessitates understanding the tradeoffs and pros and cons of a particular package as compared to another. Common tradeoffs can involve such hardware issues as computer processing speed versus computer sound and graphics. They can involve instructional issues such as the need for specific instructional content for particular students versus the need to choose a more general software package that many students can use. The tradeoff process is also a balancing act between the instructional objectives set forth in a technology plan and the desire of teachers and students to use a satisfactory software package. What may appeal to the emotional and personal desires of students or instructors may not satisfactorily meet the sound instructional objectives of the organization. The tradeoffs are numerous but the software choice should be based upon the fit between a candidate software package and the organization's goals, taking into account the cost of the software package, training required to use the software, and the amount of time and money required to update and maintain the software. It is also important to be realistic and question whether your organization has the resources on hand or could find them from other places (i.e., grants, in-kind services, etc.) for a given candidate package and its associated hardware. Taking the easy or inexpensive route is not always the best.

Once you decide what to purchase, develop a set of strategies for purchasing your selections at the lowest possible cost. Several different types of vendors sell software. The most familiar is the local computer store. Another common option is purchasing via mail-order. Mail-order houses are usually less expensive, and delivery is usually prompt. A final option is to buy directly from the vendor. A major advantage of this method is that many vendors offer discounts (up to 10-25%) to nonprofit educational organizations. You may also be eligible for government or educational pricing. Make sure to ask for the discounts before you buy; vendors will not volunteer such discounts unless they are requested.

Conclusion

The process of software selection can be anxiety ridden due to the belief that a specialized body of knowledge is required and that the process is somewhat esoteric and doomed from the outset (Turner 1993). Although it is helpful to know technology, it changes so rapidly that no one can be certain of having all the information. Choices and decision-making risks are minimized by establishing goals, previewing software, using evaluation criteria with which you are comfortable, keeping things simple, involving staff and students in the decision-making process, and using common sense.

Integrating Technology into Adult Learning

Lynda Ginsburg

The range of uses and applications of technology suggests a number of alternative approaches for integrating technology into adult basic education. There are four basic approaches to integrating technology into adult learning and instruction. The unique educational benefits as well as limitations of the four approaches are technology as curriculum, as delivery mechanism, as complement to instruction, and as instructional tool.

Technology as Curriculum

From the perspective of maximizing the acquisition of information about and competence in using specific technology applications, a curriculum focused on the computer and its applications might be desirable. Components of such a curriculum include keyboarding skills, database manipulation, spreadsheet use, word processing, desktop and Internet publishing, and Internet search skills. Hands-on opportunities to develop a comfort level with the various applications and discussions about the kinds of tasks that might be best managed with each application would provide a basis for using the technology in the various situations in which it is appropriate.

Benefits. There are a number of benefits to a "technology course" that deals only with technology applications. First, because the course focuses on technology alone, an efficient structured approach that deals with each aspect of technology in a clear, orderly, and concise way is possible. Little time is lost dealing with peripheral learning issues or any alternative goals of education beyond technology instruction. In a relatively short time, all learners have acquired a discrete set of technology skills that they are then encouraged to apply as needed.

Limitations. Such a course is limited to the content that is addressed. This is not a concern for people who do not have other educational needs that must also be addressed before goals can be reached; however, for learners whose literacy and numeracy skills are limited, one must ask if the technology skills can be applied in useful ways. Spreadsheet manipulation skills may be of little use to someone who is unsure of when and how to use parentheses in mathematics or who does not know how to compute sales tax. Similarly, any competence with word processing and electronic mail tasks will probably not be useful to a learner who is fearful of writing because she feels her writing skills are poor. Thus, any technology competence learned in such an isolated environment may not easily be applied by the learner in any meaningful ways and will probably deteriorate as an unpracticed and unused skill.

Technology as Delivery Mechanism

Another way that technology can be used in an adult education environment is as an instructional delivery mechanism. Individualized learning systems (ILS) have been designed to provide instruction and practice in each of the subskills that together forms an entire curriculum. Following an initial placement test, each learner is placed at the particular point in the sequence of programmed lessons that is appropriate for him so he does not have to work at tasks that have already been mastered and will not be given tasks for which he does not display prerequisite knowledge. Each learner's progress is tracked within the system so that a learner can return to the same subskill level at which she was working when she stopped using the system. In addition, the learner is unable to progress from one subskill to another without first achieving some predetermined level of mastery. Individual learners' progress through the series of activities can be reported to an instructor as well as to the learner.

Benefits. An ILS represents total individualization of instruction. Each learner may travel a unique branched path through the curricular content. Time need not be spent waiting for an instructor to address the needs or interests of other students. Assessment is ongoing and objective. Because the ILS can be accessed by learners at any time the system is available, the difficulties many learners have in attending classes on a regular basis or at specific times are overcome.

Limitations. Integrated learning systems are limited by the presentation and assessment of small, clearly defined subskills. Learners are given little reason or encouragement to try to integrate the subskills with other meaningful knowledge or experiences they have or to see interrelationships among the subskills. All activities focus on discrete isolated skills that are never embedded in any context other than one generated by the learning system. Research on skill transfer suggests that skills developed in a narrow, limited environment are not easily applied in other environments (Ginsburg, Gal, and Schuh 1995; Mikulecky, Albers, and Peers 1994; Nunes, Schliemann, and Carraher 1993).

Although complete individualization within a closed system can be viewed as a benefit, it can also be considered a limitation. Success in the workplace is increasingly dependent on team skills, collaborative activities, and communication skills, but an isolated learning environment does not provide opportunities to develop these skills alongside the more academic "foundation skills" such as those described in the SCANS (Secretary's Commission on Achieving Necessary Skills 1991) report.

Although the delivery of instruction takes place with the aid of computer technology, learner interactions with the computer are generally limited to retrieving the program, identifying oneself, and performing a few keystrokes or some limited keyboarding when responding to questions appearing on the monitor. Thus, although significant time is spent at a computer terminal, few technology skills are required and little usable technology competence is gained as a byproduct of using the ILS.

A final limitation of ILS programs is the high cost, both of the required software involved and of the number of computer stations that are necessary if a number of learners are to study concurrently. Since the program is individualized, learners will generally not be able to share computer equipment although, with efficient scheduling, computer equipment can be used by many learners over the course of a day.

Technology as a Complement to Instruction

Some adult education programs conduct traditional classes for adult learners but also make available opportunities for learners to use computers to practice skills addressed in class or extend learning. In some settings the instructor assigns a learner to work on a particular piece of educational software that targets a weak or undeveloped skill area; in other settings, a number of software programs are available and learners can explore and use whatever interests them. Additionally, applications software such as word processing programs or spreadsheets may be available.

Commercially available software abounds. Much of it was originally designed for the K-12 market but many pieces of software may also be appropriate for adult learners. The educational content ranges from drill and practice of routine arithmetic computations to complex simulations that require significant content knowledge, creativity, and an ability to integrate ideas from separate curricular areas.

Within this educational approach, the teacher is the primary coordinator of instruction. The extent to which the teacher integrates the technology-based activities with other classroom-based activities can vary with different teachers' styles, the kinds of software available, and whether or not learners are all assigned to work with the same piece of software. Some teachers will use drill and practice software as an alternative to handwritten practice of specific skills (particularly arithmetic computations and spelling) because many students may prefer the computerized versions and because assessment "scores" are available quickly for both the learner and teacher. Other teachers will use a computer simulation activity such as "Oregon Trail" to engage learners in an exploration of 19th-century U.S. history and/or to introduce a discussion on budgeting which in turn would lead to a budgeting activity using spreadsheets.

Benefits. The main benefit of using commercially created software is that the teacher does not have to create a resource for use by learners. Using good quality software can provide learners with a great variety of experiences that are not limited by classroom walls or by the knowledge or experiences of the teacher. Indeed, good software may also provide an opportunity for teachers, as well as students, to learn.

Additionally, some learners appreciate the opportunity to practice a target skill in private with immediate feedback; these learners may have felt uncomfortable stating aloud in class that they still felt shaky about some arithmetic operation when the rest of the class was moving on to the next topic.

Limitations. There are many commercially available pieces of software of varying educational quality, and the cost of acquiring a software library is not inconsiderable. Finding out about all of the different software packages and making good choices of what to acquire is daunting. Many organizations are developing databases of software reviews (among these is the National Center on Adult Literacy) to ease this burden somewhat, but making appropriate choices for specific teachers, learners, and programs often requires extended time to search for and experiment with the software.

Another limitation to this approach is arranging for learner access to the software. If a computer lab is not conveniently on site or is not available during convenient times, learners may not be able to access the software frequently.

Finally, the use of commercial software to complement instruction requires that teachers have time to rethink and modify classroom activities to mirror or complement the technology-based activities so the technology-based activities actually enhance classroom work. Since the software is inflexible, the teachers must provide the flexibility in the system. If teachers are unable or unwilling to be creative in this regard, the learners may be learning on two separate trajectories that are not integrated and cause confusion rather than clarification.

Technology as an Instructional Tool

In this approach, technology is seamlessly integrated into the instructional activities of the class. The primary goals and outcomes of instruction remain the stated goals of a class or program—improving literacy and numeracy skills, progress toward high school completion or another gatekeeping target, or functional skills. The development of technology-related skills is a valued, but secondary, outcome. Just as books, workbooks, a chalk board, and paper are tools that are used as needed within the classroom or to support learning, technology applications are used when they are appropriate. (Although commercially developed instructional software could be integrated into instructional activities by teachers, for purposes of contrast only generic computer applications will be included in this approach.) The form and content of instruction is completely determined and controlled by the instructor and the computer technology is used by teachers and learners as they might commonly be used in everyday environments such as a workplace, home, or library.

The added value of the technology within this approach is that educational activities can be enriched and extended with the use of technology in ways that are virtually impossible without technology. For example, learners can use word processing applications when writing essays and to edit each other's work, use a desktop publishing program to create a class newspaper, use spreadsheets to develop alternative budgets for a class picnic, and use the Internet to bring endless resources and information into the classroom (e.g., poems written by African Americans for an activity during Black History month, government statistics on joblessness, interest rates and down payment requirements for car loans, new stories from radio and print media). Electronic mail allows learners to share interests, information, and ideas with learners in other, remote classes.

Benefits. Integrating technology into instruction by using technological tools to support learning activities gives learners opportunities to develop technology skills and experiences in contexts that are similar to those in which technology is used outside the classroom. The skills gained, particularly around the meaningful use of everyday technology applications, can be transferred to other settings such as the workplace.

Educators have long decried their inability to bring realistic, meaningful activities into the classroom because of the impermeability of classroom walls. The Internet, in particular, can lower this barrier by quickly and easily bringing information and resources into the classroom. The limits of one teacher's knowledge and the limited print resources typically available in most adult education classrooms need not determine the breadth and depth of the learners' experience.

Relying on the Internet and computer applications to provide the content and context for adult learners' exposure to technology is probably less expensive than buying a collection of commercial educational software. Computer application programs such as word processing and spreadsheets are generic tools and can be used and reused. Educational software targets specific skills or activities; the content may not be appropriate for all learners in a class and may not be useful to a particular learner over a long period of time.

Limitations. The success of this approach of instruction is predicated on the willingness and ability of adult educators to develop their own classroom activities. The texts that are commonly found in adult education settings generally are designed to promote mastery of academic subskills, and are predicated upon a model of drill and practice. Curricular resources that appropriately integrate and benefit from technology are currently being developed and shared by teachers in informal settings such as conferences and listservs. More resources have been developed for the K-12 educational environment and are available on the Internet; these can be adapted for adult learners.

A further constraint that can have impact on a teacher's ability to use technology as an instructional tool is access. Convenient use of technology benefits from "as needed" access; ideally, computers (at least one) should be available within the classroom, should be connected by modem to the Internet, and should be able to send and receive electronic mail.

Choosing and Using the Different Approaches

Integrating technology into adult education instruction via any of these four approaches will require curricular change. To different degrees, each of the approaches may also have an impact on the dynamics of many classes, the role of the learner, and the role of the teacher. Although the variation among classroom structures, learners, and teachers is limitless, the addition of technology encourages movement in some directions that may be somewhat consistent across sites and roles.

Some learners may come to adult education with technology experience, whereas many others will need opportunities to develop familiarity. Learners' time and energy may have to be spent on the development of basic technology skills, including keyboarding, computer literacy, Internet search skills. Depending on the technology integration approach chosen, the particular skills needed in a particular classroom may vary, but to maximize learners' ability to interact with and benefit from technology beyond the classroom, provision of a full complement of technology experiences may be desirable.

The fourth integration approach—technology as instructional tool—probably has the greatest impact on the classroom environment, learners, and teachers. The most powerful and engaging educational activities that use technology are those that are complex, realistic, and may have more than one reasonable methodology and answer. Just as real world problems and situations often require the input and support of a number of people working together, learners can work together in teams to collect information, brainstorm and weigh alternatives, plan, and come to a solution. For example, a class with Internet access could be given the task:

> *I need help planning my trip. This winter vacation I want to spend a week in a place with a temperature that is likely to be at least 80 degrees. I like to swim so a beach would be nice. I also like to go site seeing so there should be something of interest in the area. I don't own a car so you have to decide how I will travel and where I will stay. I have $1000 to spend on this trip. Please write me a letter and tell me of the plans you have for my trip, how your plan meets my requirements, and how much everything will cost.*

Such a problem does not have one answer or one solution path, the task is reasonable and realistic, and the information needed is accessible. Working in pairs or groups is efficient and more fun, and it reduces the possibility that someone will get stuck on one aspect of the problem and not be able to progress. Learners have an opportunity to communicate orally and in writing and practice writing a business letter. The activity has research, geography, and math components. Activities such as this can help learners develop and hone skills in a holistic environment. The emphasis is not on acquiring discrete skills but rather on developing problem-solving strategies and applying knowledge and skills in meaningful ways.

In such an instructional environment, the role of the teacher is very different from the "sage on the stage." The teacher is not the sole source of information; indeed the teacher will not know in advance the "answers" that the learners propose. Instead, the teacher provides guidance as needed to groups of learners. Upon completion of the activity, the teacher might facilitate a discussion of the problem-solving approaches and group processes learners used.

In such an environment, learners are much more independent and active than in an educational environment that is focused on the acquisition of discrete subskills. They are expected to gather information and make, communicate, and justify their decisions. Their own experiences can contribute to their work.

Conclusions

The integration of technology into instruction, particularly when used as an instructional tool, can empower learners to take more responsibility for their own learning and creates a powerful learning environment. However, the integration of technology into adult education instruction is a worthwhile but daunting task. Teachers' and learners' expectations of classroom structure, curricula, support materials, roles, and instructional activities may all need to be re-evaluated and revised. This is an unsettling process, but it is also an opportunity to question assumptions, experiment, and ultimately improve the delivery of education to adults. We all acknowledge that the information age has had a profound impact on the world around us; thus it is not unreasonable to posit that the information age should also affect the form and function of adult education. However, integrating technology into instruction in meaningful, constructive ways requires that those charged with the task be aware of alternatives and feel comfortable exploring and experimenting to arrive at a workable implementation.

Recommendations for Using Technology in Adult Education

Christopher E. Hopey

A few overarching lessons can be captured from the experiences of others who have embarked on the educational technology path. Although everyone who embarks on a technology journey may take different paths, most end up in the same place—excited, happy, and thankful they took the time and expended the resources to get started with technology. From their experiences and mine, I can recommend the following:

- **Using technology requires encouragement and a vision.** The hardest thing about implementing technology isn't the cables, routers, and computers; it is figuring out how to enlighten teachers and provide them with the encouragement and vision they need to use technology.

- **Technology must be supported at the classroom level.** Once teachers are enlightened, you can't abandon them and move onto the next project. Nothing will turn a teacher off more quickly than a lack of support.

- **Teachers can be champions.** Leadership is different than management. Teachers can be leaders and when they step up to the plate, get out of their way and let them be champions. Others will follow their examples of how best to use technology with learners. Give teachers the opportunity to be imaginative, creative, and innovative with technology.

- **There is never enough time.** Implementation takes time and measures must be taken to ensure that teachers don't feel as if technology is taking them away from their primary responsibilities of teaching adult learners.

- **Every action has a reaction.** If a new way of using technology is implemented it will affect how a teacher teaches and a learner learns. New opportunities for using technology are exciting for most. However, they can also create anxieties for others. The rule of thumb is that change affects everyone, some in very positive ways. For others it may be negative. Use some basic common sense. If a new idea is being implemented, don't force it; such forced actions will create a reaction.

- **Expect the unexpected.** Plan for the best but prepare for the worst. Even if all the education processes are perfect, it doesn't work if the Internet provider goes down or the computer crashes.

- **Keep things simple.** Simplicity is the best policy. Technology itself creates cognitive overloads. There is no reason for human beings to make things more complex than they have to be.

Section II:
Moving Forward

The papers in Section II are authored by six experts in the field of adult education. Collectively, they have more than 40 years experience using technology in adult education programs. The papers move from theory to practical applications of technology and address assessment, distance learning, the Internet, and policy issues.

Adult Learning Theory: An Argument for Technology

Regie Stites

Learning is an inescapable fact of life. From the day we are born to the day we die we are constantly learning. In many ways, learning in adulthood is indistinguishable from learning in childhood. Yet there are important differences between adult and childhood learning that make a difference in the design of instruction for adults and in the role that technology can play in supporting learning by adults. One obvious source of these differences stems from the developmental differences of adults and children. Another source of difference is related to the distinctive goals of adult and childhood learning. A third set of differences is related to the fact that most adult learning and instruction occurs outside of the context of formal schooling. These three areas of difference have each inspired a variety of theories of adult learning and corresponding approaches to adult instruction.

The range of designs for adult instruction can be placed on a continuum that has training at one end, teaching in the middle, and self-directed learning at the other extreme. The type of learning theory that one might choose to guide an instructional design for adults will depend in large part on where the desired form of instruction falls on this continuum. Likewise, the role and potential for the use of technology in support of adult learning changes as one moves from training to teaching to self-directed inquiry. Applications of technology within adult education have most often supported instructional designs at the training end of the continuum. For example, computer-based instruction and integrated learning systems that take learners through a step-by-step programmed course of instruction have become quite common in adult education. Incorporating technology into instructional designs that fall nearer the self-directed end of the continuum has been less common. Yet it is here that advanced networking technologies have the potential to make the greatest contributions to adult education.

Advanced information technologies have created the potential for adults to have access to worlds of information in ways that scarcely could have been imagined a generation ago. Such technologies are particularly well-suited to supporting instruction that is learner-centered, problem-focused, discursive, and contextualized. In other words, emerging information technologies provide unprecedented opportunities to design environments that support self-directed learning by adults.

Understanding Learning across the Lifespan

Historically, theories of learning and resulting approaches to instruction have emerged from interest in the processes of learning and development in childhood. Writers on adult education often point out that the term "pedagogy" is derived from Greek words meaning "child" and "to lead" and many adult learning theories have been constructed by drawing contrasts between learning by children and learning by adults. The term "andragogy" (in contrast to pedagogy, used to designate the particular "art and science of teaching adults") emerged in Europe in the early 19th century (see Knowles 1990; Krajnc 1989). Malcolm Knowles (1970, 1980) is the writer whose work is most closely associated in the United States with the idea of andragogy as a separate area of educational theory and practice. In his early works on the subject, Knowles emphasized the differences between adult and childhood learning and instruction, but more recently he concluded that the learning principles of andragogy can be applied to instruction of all ages. This shift in thinking is reflected in the changing subtitles of his influential book ***The Modern Practice of Adult Education***. The first (1970) edition of the book bore the subtitle "Andragogy versus Pedagogy" whereas the second (1980) edition was subtitled "From Pedagogy to Andragogy."

Although contrasting the developmental attributes of children and adults has been a productive line of inquiry for many theorists, others have sought to characterize varieties of learning that occur at all stages of life. Cyril Houle (1974, 1984), another leading theorist of adult education, starts with the assumption that the learning processes of adults and children are "fundamentally the same" and differentiates theories of learning and instruction by the ways in which each addresses four key concerns: the nature of the learner, the goals sought, the social and physical milieu of instruction, and the techniques of learning or teaching (Houle, 1974, p. 5 [cited in Merriam, 1987, p. 189]). The first three of Houle's concerns provide a basis for characterizing the differences between pedagogy and andragogy, on the one hand, as well the differences among various approaches to adult learning and instruction. The choice of focus for a particular approach to adult education—whether it be adult characteristics, goals for adult learning, or the context of adult learning—will, in theory, have implications as to the nature of the techniques of learning and teaching advocated by a given approach.

Characteristics of Adult Learners

Approaches to adult learning and instruction based on identification of the characteristics of adult learners have a long and rich history in the United States. Building on the work of John Dewey, Eduard Lindeman (1926) was among the first to explore the distinctive characteristics of adult learners. Knowles incorporated much of Lindeman's thinking into his own work and found that many of Lindeman's key assumptions about the characteristics of adult learners have been supported by later research. According to Knowles (1990), many of the characteristics of adult learners first identified by Lindeman remain the "foundation stones of modern adult learning theory." Knowles summarizes Lindeman's contributions as follows:

1. Adults are motivated to learn as they experience needs and interests that learning will satisfy; therefore, these are the appropriate starting points for organizing adult learning activities.

2. Adults' orientation to learning is life centered; therefore, the appropriate units for organizing adult learning are life situations, not subjects.

3. Experience is the richest resource for adults' learning; therefore, the core methodology of adult education is the analysis of experience.

4. Adults have a deep need to be self-directing; therefore, the role of the teacher is to engage in a process of mutual inquiry with them rather than to transmit his or her knowledge to them and then evaluate their conformity to it.

5. Individual differences among people increase with age; therefore, adult education must make optimal provision for differences in style, time, place, and pace of learning. (p. 31)

A variety of approaches to instruction have been elaborated upon these assumptions about the characteristics of adult learners, including Knowles' own theory of andragogy (Knowles 1975, 1984, 1980) and Patricia Cross's (1981) Characteristics of Adults as Learners (CAL) model, among others. (For a brief description of these and other theories of adult learning see Merriam, 1987.) A number of Lindeman's assumptions also converge with ideas about adult learning from theorists outside the andragogical school.

Goals of Adult Learning

Recognition of differences in the goals of adult and childhood learning has been another focal area for development of approaches to adult instruction. Among the most influential of the goal-focused approaches have been those that are rooted in humanist philosophy and that stress the political dimensions of adult education. Internationally, the work of the Brazilian educational philosopher, Paulo Freire (1970), has had a profound impact on theories of adult learning and instruction. Freire viewed all education as either liberating or oppressive and argued for an approach to adult education that has as its goals raising consciousness of social inequities and motivating learners to take action to achieve social transformation. Inspired by Freire and by the critical theorist, Jurgen Habermas, a number of North American writers have developed approaches to adult education founded on principles of critical reflection and empowerment (Hart 1992; Mezirow 1981; Welton, 1995). Jack Mezirow's (1981, 1985, 1995) theory of Perspective Transformation is among the most fully elaborated approaches of this type. Following Habermas, Mezirow defines a role for adult education framed by discourse ethics and the goal of emancipation:

> The social goal toward which adult education strives is one in which all members of society may engage freely and fully in rational discourse and action without this process being

> subverted by the system. Such subversion occurs in everyday life when communications become distorted by unequal distributions of power and influence. Transformation theory holds that adult education's intervention is to redress this distortion or "violence" by creating protective learning environments with norms which assure everyone more free and full participation in emancipatory discourse. (Mezirow 1995, p. 57)

The concept of free and undistorted communication as the principal aim and method of adult learning (Freire's dialogue and Habermas' "communicative competence") is the cornerstone of critical approaches to adult education. This idea coincides quite closely to the andragogical notion of adults as self-directed learners.

Contexts of Learning

Consideration of the effects of variations in social and physical contexts on learning processes has also had a major impact on developments in adult learning theory in recent years. Building on detailed studies of learning and problem solving in real world contexts, models of "cognitive apprenticeship" (Collins, Brown, and Newman 1989) and "situated learning" (Lave and Wenger 1991) have led instructional designers to consider ways of shaping the contexts as well as the processes of instruction. Attention to the ways that learning processes differ in school and out-of-school contexts has been a key focus for cognitive learning theorists. In her presidential address to the American Educational Research Association, Lauren Resnick (1987) identified four critical ways in which learning out of school differs from learning in school:

1. School learning and performance is mostly individual whereas functioning successfully outside of school often entails group work.

2. School stresses mental activities or "pure thought" whereas cognitive activities outside of school are more often shaped by and dependent on the availability and use of tools.

3. School thinking is often decontextualized symbol manipulation, whereas outside of school reasoning is done in context and is directly connected to objects and events.

4. Schools stress generalizable reasoning skills whereas outside of school situation-specific forms of competence are required.

Cognitive learning theory and findings from studies of informal (out-of-school) learning have found broad applications in adult education (see Flannery 1993). This has been reflected in the development of approaches to adult learning that are responsive to individual differences in perceptual modalities (visual, aural, and psychomotor) and learning styles (Cawley et al. 1976; James and Galbraith 1985) as well as differences in affect (Ferro 1993). It has also led to methods for directly addressing the goal of "learning how to learn" in adult education (Smith 1982). In these ways, cognitive learning theorists have validated and provided empirical justification for many long-held assumptions about adult learning and instruction.

Technology and Adult Learning Theory

Adult learning theory and research has identified a number of key specifications for the design of technology-based environments for self-directed learning by adults. In general, learning environments for adults should use technology in ways that maximize opportunities for learner-centered, problem-focused, discursive, and contextualized learning.

Technology can support learner-centered instructional design by providing learners with choices among a range of learning styles and modalities. Multimedia technologies are able to accomplish this by giving learners direct control of the mix of text, audio, and visual presentation of new information.

Similarly, technology can be used to support problem-focused instructional design by allowing adult learners to control the pacing, scope, and sequence of information and to direct inquiry toward individually relevant questions and learning needs. Electronic databases enable individual learners to tailor the breadth and depth of their explorations of chosen topics.

A discursive design for technology-based learning environments is desirable in order to take advantage of adult experience in interactive learning and group problem solving. The opportunities for asynchronous and synchronous dialogue afforded by networking technologies are especially powerful tools for adult learning.

Finally, technology-based learning environments for adults can provide rich contextualization for learning. In some cases, learning of situation-specific skills and knowledge can be achieved through computer simulations of real world contexts. In other cases, technology may itself be the authentic environment for learning and practice.

Technology in Adult Education Programs

Terilyn C. Turner

Technology is used in adult education programs for management, instructional support, and direct instruction. The chronology for technology acquisition usually follows this same pattern, with management functions occurring first.

The Uses of Technology in Adult Education

Management

In a survey by the Office of Technology Assessment, "All of the technology-using programs surveyed . . . reported using computers for administrative purposes, such as general correspondence, registration and scheduling, record keeping, budgeting and payroll, student tracking evaluation and planning, and mandated reports" (Sivin-Kachal and Bialo 1992, p. 53).

Most adult literacy programs, whether ABE/GED, community based, volunteer, or institutional, begin using computers to maintain records on learners for state reports or local funders. Electronic transfers of information are increasingly supported at the state and federal level. Both financial information and state reporting can be supplied in a timely fashion, eliminating the need to generate paper documents.

Websites have been created by federal, state, and local governments to facilitate accessing information for grants, legislation, and events. Increasingly, legislative bills can be sent electronically to literacy programs for review prior to voting. Politically active literacy networks have flooded fax machines and e-mail boxes in attempts to communicate with legislators.

Microcomputers are used to maintain student test scores, records, and grades. Literacy councils may use computers to facilitate student-tutor matching through zip codes maintained in databases. Word processing is used extensively to send letters to tutors and students in a standardized format in nearly all literacy programs.

The use of publication and presentation software is increasingly found in literacy programs. Newsletters are developed using desktop software with digitized photos. Access to more sophisticated technology is often through someone's personal equipment that is shared by a tutor or teacher working at home or at their business.

Networks of tutors, teachers, and learners are becoming increasingly common. Although some literacy programs have been networked for many years (the State of New York's Literacy Volunteers of America programs, for example), others are just beginning. Issues of maintaining chat rooms, finding viable topics for conversation, and technical problems are the same for literacy users as they are for the rest of the world. Finding the time to research websites, prepare materials, and respond to queries are issues concerning literacy practitioners.

Instructional Support

The generation of materials and resources to be used with learners is called instructional support technology. Word processing is used to generate tests and text materials for basic literacy instruction. Games and crossword puzzles requiring the use of a printer allow teachers to enrich their teaching by supplementing instruction with computer-generated materials. These can be designed specifically for an individual learner's needs and personalized by the addition of the learner's name. Readability formula software packages that establish grade levels can be applied to materials learners bring in to read as a means of determining appropriate teaching strategies. In classes, integrated learning systems (ILS) and software packages generate personalized worksheets that can be given out as a homework activity.

The computer can be used to facilitate the instructional process by supporting staff development activities. Brainstorming software is used as part of workshops to generate new ideas. Another use of the computer is to record key points in small- or large-group discussions. The notes are then given as a report to all participants at the end of the workshop. Teachers can develop curricula across time and space by sharing materials over the Internet. Production of instructional materials, sharing of resources, and creation of learner forums are all activities in which literacy practitioners are engaged.

Technology supports the instructional process in testing. Scoring of tests, generation of random items, and creation of tests can all be done with a computer. Centralized scoring of GED tests has increased the possibility of data maintained and shared across time and space among programs. Systems such as CASAS (Comprehensive Adult Student Assessment System) also provide models for systematic data collection through technology. ILSs have long been able to generate test data that provide learners with profiles on their progress as well as generating aggregate data for program reporting purposes. Standardized tests such as TABE (Test of Adult Basic Education) and the GED are also available in computerized form.

Direct Instruction

Direct instruction occurs when a learner uses technology, usually a computer, to learn. In most adult literacy programs the use of the computer is supplemental. An Office of Technology Assessment survey found that "most programs are using computers principally as a supplement to a traditional program of classroom-based instruction" (U.S. Congress 1993). A common configuration in a classroom is to have the computers located in the back or at the side of the room, usually in a row. If possible, a second room is added to create a computer lab. At least one printer is available to generate hard copies. Increasingly, peripherals are attached to provide sound, scanning, and video capabilities.

The least frequent application of technology, although often the most discussed, is where technology is the primary means of instruction. In this situation a computer lab with at least one ILS is employed. Commercially available ILSs as well as standalone computers and other technologies are used. Even where technology is the primary means of instruction, there are always teachers or tutors, books, paper and pencils. In addition to the ILS as a technology delivery system, most vendors also supply support materials in the form of videos, workbooks, worksheets, and/or tests. Technology has never been used as the sole deliverer of instruction in adult literacy programs, except perhaps in an administrator's or vendor's mind.

Development of a total curricular system using technology requires a substantial financial investment. The advantage of an ILS is that of offering a "turn-key" operation, ideal for a new program or site.

A "turn-key operation" is one that enables a literacy provider to purchase all services from one vendor and establish a fully operational lab at the outset. Technology used as the primary means of instruction can provide an instructional management and tracking mechanism that was previously unavailable in adult literacy programs. The ability to provide individualized instruction while collecting aggregate data for reporting purposes is a major advantage. Experimental systems have been developed in the past, primarily on mainframe computers by universities and the military; however, these have not been available to the general public. The systems that currently exist commercially are a combination of ILSs and curricular packages.

Many technology specialists believe that the use of ILSs is destined to be a passing phenomenon, making debate about their merits a relatively moot point. Indeed, the inclusion of third-party software at the literacy programs' request and increased capability of the ILS to be customized for user needs has challenged many of the traditional assumptions of what an ILS can and cannot do. Now, the delivery of ILS curriculum via the Internet and ultimately through platforms such as Java changes the entire structure of the ILS. Soon we can expect to see curriculum delivered on demand that is learner specific, without losing the capability of generating individual and aggregate data for reporting purposes. In fact, there is every likelihood of greater sharing of data across programs to arrive at new understandings of how learners learn through technology.

Programmatic Uses of Technology

In order to understand the use of technology in adult education instruction, the larger context must first be recognized. Although all adult education programs provide basic skills instruction, individual programs vary widely in their mission, funding, clients, curriculum, evaluation, and general operation. Largely due to the institutional context and historical origins, adult education programs set boundaries for their service delivery. This section describes the context for technology use and current issues in four program categories: ABE/GED/adult diploma, ESL, work force literacy, and family literacy.

ABE/GED/Adult Diploma

Adult basic education is the single largest provider of adult literacy services in the United States. ABE programs provide services to adults 16 years of age and older, who are out of school and functioning below a high school completion level. Funding is federal, administered through the state, and often combined with state and local dollars or other sources of revenue. ABE programs are likely to provide GED instruction as well, in order to provide a full range of options for learners. The Test of General Educational Development has offered an alternative to the high school diploma in the United States and Canada since 1942.

Since most instruction in these type of programs is individualized within the classroom, the use of computers varies markedly from program to program, and teacher to teacher. Technology is viewed by most teachers as supplemental to the regular curriculum and used as a resource when it fits into the individual learning plan of the student. Technology is frequently a mix of current software and obsolete hardware. It is not uncommon to find a multimedia encyclopedia sharing a work table with Apple IIEs or PC Juniors. It is less common to find Internet access and modems in use.

The GED has a long history of seeking technological solutions for delivery of services. Kentucky Educational Television has been delivering the KET/GED series on broadcast television since the early 1970s. The original format has been expanded to include telephone and correspondence support, videotapes, and interactive video capability. Available as "Beyond Words," the KET series works on networked or standalone platforms (see KET 1992). More recently, GED instruction is being offered through the Internet. Projects such as Mindquest are exploring the potential of delivering GED instruction in multiple formats.

In addition, most classrooms have VCRs, often with instructional videos. Audiotapes and tape recorders, as well as older technologies such as language masters or controlled readers, are also used extensively in most ABE/GED classrooms.

Adult diploma programs, sometimes known as Adult Secondary Education (ASE), programs are a fairly recent phenomenon. An alternative to the GED, these offer a high school diploma as a credential rather than the GED certificate for passing five tests. To the degree that adult diploma programs are integrated into the regular district offerings, access to technology and other district resources is less a problem than for other literacy programs.

A major concern currently confronting all of these types of programs is the growing need for accountability. Technology provides good news and bad news in this area. The bad news is that programs will often purchase an ILS specifically because of the data it will provide on learner progress. The data are intended to be used to justify the program's existence. When claims made cannot be fulfilled, both learners and funders are frustrated.

The good news is that technology does promise the means for resolving the current conflict between authentic assessment and accountability. The demand for accountability in adult basic education is a theme currently found in state and federal legislation, articles, and public documents. Likewise, the private sector is increasingly reluctant to put dollars into adult literacy programs where outcomes cannot be substantiated and the population is highly transient.

Finally, finding an appropriate location for tutors, teachers, and learners to meet is an ongoing problem for all adult education programs, especially programs dependent on volunteers. Home delivery of instruction through newly developing camera/computer technologies such as CUSeeMe offer the potential for matching tutors and students across time and space. Many seniors and people with disabilities would be delighted to share their instructional expertise if they could remain at home. Mechanisms that would allow volunteers to operate within the safety and convenience of their homes, while affording learners increased privacy and ease, are very appealing. Learners can be in prisons or remote areas and still find high quality tutoring through Internet and distance delivery.

English as a Second Language

Some of the most interesting and creative uses of technology are to be found in ESL programs. These programs may be part of a larger ABE/GED project or exist independently as part of a community-based organization. Frequently, the creativity is a result of necessity because software does not exist to meet the diverse language and literacy needs of learners.

Technologies such as tapes, language masters, learning labs, radio, and television have long been used in English language training, where oral language and sound are essential to the instructional process. Newer applications are a result of the development of high quality sound systems for the computer with authoring capability. Teachers and tutors now use software packages with sound to teach correct pronunciation; a learner can hear her voice in comparison with a standard. The standard may be part of the software package or authored by the teacher. Authoring packages provide programs with the flexibility needed to create instructional exercises in languages specifically for English language learners.

Closed-captioned television is also used by immigrants to learn the English language. This method has been used instructionally in a limited way, but holds great promise for the future when all televisions have closed-captioned and/or interactive capability.

One of the most successful uses of the Internet in adult literacy instruction is in the area of ESL. Learners can find websites from their countries of origin and can keep up with current events in their native country. In some cases they have been able to connect with relatives, providing an immediate benefit to attending literacy classes. Of equal value has been the education of teachers who can learn about the countries of origin of their students. In urban literacy programs with learners from many different countries, it is virtually impossible to have intimate knowledge of all learners' homelands. Through webpages and e-mail teachers are learning along with their learners and can better customize instruction to learner needs and interests.

Online chat groups and websites devoted to serving the needs of a specific population are a growing phenomenon. Although designed with communication rather than education as a purpose, these technology forums provide mechanisms to tailor ESL instruction in new and creative ways. It is to be hoped that new technologies that connect people around the globe will afford increased options for learners to learn English in ways that have yet to be fully conceived, much less employed.

Virtual reality has also been used in ESL experimentally to create "literacy worlds." Telecommunications enables learners to access databases, form networks, and correspond electronically. Educators stress the need for real purposes for learners to use the systems and the difficulty of integrating online usage into the curriculum, a view supported by educational research in K-12 programs.

Work Force Literacy

Work force literacy refers to basic skills instruction that is conducted for those currently employed, seeking employment, or changing employment. It is usually, but not always, conducted at a worksite. Also known as workplace, work site, or employment training, work force literacy has a long history under many different labels. Major work force literacy programs are also offered in union halls and as part of an existing ABE or community college program. Vocational schools offer basic skills instruction as part of their preparation for the job market and through customized training for companies.

Unlike some educators who are resistant to technology as a primary means of instruction, employers frequently seek a technological solution first. They are impatient and easily succumb to promises of "2 grade level improvement in 30 hours of instruction." This has led to difficult situations in which literacy providers are asked to provide support services for technology that they did not want. ILSs are frequently found in work force literacy programs because they provide the data employers want, allow flexible scheduling, and quick solutions.

Far more difficult to achieve and desperately needed are technological solutions that are grounded in the functional context philosophy of most work force literacy programs (Park 1987). Functional context literacy supports the notion that for basic skills instruction to be meaningful and lasting, it must be delivered within a specific context, such as the requirements of a particular job (Sticht 1988). Technology in the form of video, computer software, and tapes is currently used to provide the type of functional context instruction required in the workplace. The ability to customize a curriculum for each employer and employee has yet to be developed. Unfortunately, this application of technology rarely occurs. In some cases there is simply not enough expertise in the dual worlds of literacy and training to develop a functional context curriculum that would employ the latest technology. In other cases the limitation is in the technology itself where software development lags behind instructional demands.

Family Literacy

Family literacy programs continue to grow in popularity and are often found as stand-alone projects. Although definitions and program design differ, family literacy programs share a common belief that literacy issues must be addressed through the unit of the family, not the child or adult. They believe that breaking the cycle of illiteracy can be done only through an intergenerational approach in which children and adults are taught simultaneously.

Most programs involve three component parts: instruction for the child, instruction for the adult, and instruction for the parent and child together. Technology can be used to support the instruction for any or all of these strands. The use of technology varies markedly from one family literacy project to the next; however, many use technology for some portion of the program.

Family literacy programs use technology in as many different ways as families use computers. Where an ILS is available, several family members can work on basic skills together by having several headphones attached to the computer. This is particularly useful in learning English. Another common application is the creation of letters, greeting cards, and banners, allowing a parent and child to work together on the project. Other software programs that work well for intergenerational activities are those that create toys or games. Children and adults can work together to design a product that will benefit another family member. Genealogy packages have also been used in family literacy programs to trace family roots and transmit stories from parents to children.

The Internet has allowed family literacy projects to share information across programs. One of the first applications was to connect parents in a network support group to discuss child rearing issues. At the National Center for Family Literacy, electronic bulletin boards were used to facilitate parent-parent, child-child, and teacher-teacher communication. Teachers and parents became increasingly frequent users of the system, sharing curricular issues, parenting needs, and recommendations for conducting successful family literacy activities with each other. Another project between Oregon and New York encouraged parent communication, not only on child-rearing issues, but partnering for parents in completing their GEDs.

In volunteer literacy programs, video and audiotapes are used effectively in family literacy programs to support parents with beginning reading skills. The Reading Rainbow television series and Walt Disney tapes are used to teach parents how to read to their children. Parents can hear and see the story using technology to enhance their understanding of the plot. Small-group instruction provides support for parents on how to read the story, as well as the words they will need to know. Some programs provide portable, take-home computers, for parents to use with their children as part of a language development process.

Electronic education for an entire family is a discussion topic at many education, technology, and literacy conferences. There is a lack of vision on how to go about doing it. The experiences of Sesame Street and KET show that it is possible to educate a segment of the population through home delivery of instruction.

Final Considerations

The most recent developments in the area of technology call into question many assumptions about adult education, as learners begin to use the computer for communicating and accessing information electronically. Multimedia, telecommunications, and incorporation of the computer into other tools (such as glasses, notebooks, and calculators) create a very different image of what adult literacy instruction could be, and many hope, will be. Adult literacy practitioners need to be in the forefront of determining how evolving technology will be employed to achieve literacy goals. Clarity of vision and advocacy are needed to ensure access to new technologies, development of appropriate content, and new models of instruction.

Access to New Technologies

Historically, literacy programs have been the last to access a new technology. This is principally due to lack of funding for the literacy field in general. However, it has also resulted from a lack of demand and vision on the part of literacy practitioners. Failure to conceive how new technologies could be used in the classroom or tutoring situation often results in their arrival in literacy programs at the point when they were being discarded as obsolete by other educators. To be at the forefront of advocating for new technologies in the literacy field, practitioners must be able to articulate what the potential of the new technology is for their learners. Visioning and dreaming are best carried out by observing the fields of entertainment, military, or business, where new technologies are most likely to emerge.

The questions practitioners should ask when encountering a new technology (for example, when ordering video breakfast in a hotel, or seeing holographic images on a pen) are—

- What could this technology do for my students?
- How could it be adapted and used for a literacy purpose?
- What would it take to make the adaptation?
- Who can I talk with about this need?

Development of Appropriate Content

There is very little software designed specifically for family literacy programs. Consequently, software must be adapted for the activity. Many of the new technologies provide electronic connections without any content. As one instructor cynically remarked, "When we all get hooked up, just what are we going to talk about anyway?" Public broadcasting now has 499 additional television channels, many of which could be used for educational purposes. As Linda Roberts, former Senior Policy Analyst of the Office of Technology Assessment said, "Does the world need 499 shopping channels?"

The same question has been asked regarding the value of the Internet for literacy instruction. In one literacy program a student desiring to purchase a used car spent 1 month reading classified ads as part of his reading class. The issue debated by staff was whether this was valid preparation for the GED and whether a policy should be established limiting this type of access.

Without vigorous debate on these issues, decisions will be made by legislators, vendors, and technology purveyors. If adult literacy professionals have not thought through content issues, then someone else will, and content will be predetermined and prepackaged by those without an understanding of the literacy field. Literacy practitioners must be in a position to answer these questions:

- How should content be determined for the new technologies?
- Should learners make the decisions in light of their own individual learning plans? Or should accountability drive the decision ensuring an outcome of GED, high school diploma, or English acquisition?

New Models of Instruction

> Our students are less and less able to perform the old print rituals—to read, or analyze, or write with clarity and purpose. Everything that they encounter in the world around them gives the same signal: that was then, and electronic communications are now. (Birkerts 1993, p. 105)

Changes in the meaning of "literacy" have profound implications for literacy practitioners. The death of the printed word and emergence of the symbolic era have been forecast by many. Whether this ever occurs is beside the point. The potential and the reality for many learners is the ability to learn through a variety of new modalities that are multisensory and multidimensional.

The issue is less one of technology, than of literacy itself. Adult literacy practitioners must be thoughtful in their approach to knowledge and how instruction is to be delivered. When constructing future scenarios for learning the emphasis can no longer be on the teacher/learner relationship with a view of technology as "just a tool." This permits practitioners to remain naive, ultimately asking the wrong questions, such as "How can we get students to come to class?" instead of "How can we deliver instruction without a classroom?"

New models of learning will occur as practitioners become comfortable with new technologies and less dependent upon learners to meet their emotional needs. Adult literacy practitioners need to debate and reflect upon how new instructional models can be created that actually place control in the hands of the learner, while providing the certification and validation necessary to achieve specific goals. Questions that need to be discussed are—

- How can we facilitate learning in any time and any place?
- What kind of support systems need to be in place to ensure a successful learning experience?
- How can independent learning be validated and certified?
- How can the new media of chat rooms, e-mail, virtual reality, and others yet to be conceived best be employed in the literacy context?

A great educational philosopher, Theodore Brameld, once said, "There are times when the most practical thing one can do is become theoretical." This is such a time. Many of the issues confronting the field of adult literacy and technology will not be resolved through technological solutions. Rather, they require practitioners who are thoroughly grounded in adult education, learning theory, assessment, curriculum design, and evaluation to reflect upon issues of practice. The time for debate is now; the solutions and resolutions of technology/literacy issues lie in the future.

Using Technology for Assessment in Adult Learning

John P. Sabatini

The topics of assessment and testing make most learners and teachers uncomfortable. The culture of testing in educational settings typically involves routinized/dull standardized procedures, security surrounding test materials, suspicion of examinees' motives and actions, secretive and occult treatment and reporting of results, and critical/punitive consequences. Time-consuming, high-stakes tests such as the Scholastic Aptitude Test (SAT) and the General Education Development (GED) embody all these aspects and do little to improve the public relations of testing. No wonder test anxiety is an important psychological variable considered in test data analysis. At best, tests are recognized as necessary evils for gathering information for student placement, diagnosis, achievement, or program evaluation purposes. As often, they are criticized as a waste of precious instructional time.

The combination of technology and assessment, on the other hand, creates a different culture of testing. Individuals of all types enjoy self-tests of their trivia knowledge or competing for the fastest time or highest score in a simulated performance such as driving a race car or shooting bandits in a saloon. The military uses the motivational benefits of computerized testing and simulation with success throughout their training operations. In fact, the success of video game-style testing suggests a new assessment paradigm: delivery of the GED exam in short segments as part of arcade games in taverns. In addition, if individuals were charged 50 cents every minute to continue to play to improve their score, literacy levels nationwide might begin to climb in a matter of months.

Perhaps I have engaged in too much hyperbole. Still, the promise of technology applied to assessment is profound. From computerized adaptive testing (Wainer 1990) to intelligent measurement (Lesgold, Ivill-Friel, and Bonar 1989), there are new and boundless possibilities for making assessment both tailored to the individual and more integral to the educational process. In many cases, the distinction between assessment and instruction is being erased (Venezky and Sabatini, forthcoming). Even technically simple computerized tests represent paradigm shifts when compared to the culture of testing that has grown out of paper and pencil technology. Combined with constructivist and other learner-centered theories of instruction, the new technology-based assessment models can become an integral part of instruction.

This chapter consists of two major sections. In the first, the use of computerized assessments in the SARA study is described. SARA can be considered a case study of how technology is changing the culture of testing such that more targeted information about specific learners can be obtained and used in instructional settings. In the second section, a brief review of computerized adaptive testing is used to introduce the idea of a learner-centered assessment system.

SARA: An Assessment and Technology Case Study

The Study of Adult Reading Acquisition (SARA) was a longitudinal research project designed to measure the development of reading subskills of adults enrolled in instructional programs. The study participants were enrolled in a variety of adult education sites and settings including correctional institutions, community-based programs, adult basic education (ABE) classes, general educational development (GED) classes, public assistance job programs, and tutoring services. The study design serves as a model for using achievement tests in conjunction with cognitive assessments as part of a comprehensive assessment strategy. As in traditional assessment programs, achievement tests were administered at intervals of instruction appropriate for observing reliable change. In addition, SARA added cognitive assessments that were given at more closely spaced intervals to monitor stability or change in underlying skills or to decide whether additional diagnostic measures would be helpful.

Participants were monitored over a 6-7 month period while they were enrolled in instructional programs. Over the course of the study participants received a variety of tests over a number of sessions. Each participant received an initial battery of baseline tests, then a battery of repeated measures every 5-7 weeks. Follow-up achievement and diagnostic tests were also administered. Participants were also screened for vision and hearing problems and were interviewed about their reading and leisure habits and educational backgrounds.

Overall SARA Assessment Strategy

A review of existing published paper and pencil achievement tests showed that, although able to rank adults on a single reading ability scale, most fail to capture the complexity of adult learners' literacy development and do not provide instructors with diagnostic information sufficient for making instructional decisions (Sabatini, Venezky, and Bristow 1995; Venezky, Bristow, and Sabatini 1994; Venezky, Sabatini, Brooks, and Carino 1997). Although normed for adult populations, most published tests for adult learners are linked to elementary and secondary school developmental scales such as grade level.

Because the assumptions used to support the validity of published test series at elementary and secondary levels are not necessarily valid for adult learners, the assessment strategy used in the SARA study combined both reading achievement tests and cognitive assessments in instructional settings. The cognitive assessments were computerized, short in duration, and targeted. The total time adults can devote to full-time instruction and learning is constrained and often interrupted by external demands, suggesting the need for finer grain monitoring of skill consolidation, maintenance, and retention than is possible with global achievement tests.

The published achievement tests were administered in a traditional manner; however, the SARA project computerized many of the cognitive assessments given to adult learners.

SARA and the Advantages of Computerized Assessment

Cognitive assessments such as the ones used in SARA are measures that are based upon models of the cognitive processing skills or components critical to skilled reading. The battery of tests in the SARA project were used to monitor the levels of three cognitive processing components central to reading acquisition: decoding, word recognition, and sentence processing. The tests included both accuracy and rate measures so that both overall reading performance abilities and efficiency of skill application could be assessed.

Although it is not necessary to computerize such assessment tasks and tests, the computerized administration of these tests in the SARA project and for future uses highlight the advantages of computerized testing and assessment in adult education. These advantages include—

- Test administration, which can be standardized with technology. Programmed tutorials with audio assistance like the ones used in SARA lead students through instructions, demonstration items, practice items, and test items.
- Learners have control of the test situation. They are active participants, not passive test takers.
- Learners can work at their own pace, yet performance rate information can be collected and analyzed. The information is crucial for assessing fluency and automaticity.
- Learners gain a sense of privacy. They are given a private space to work, with headsets to listen to instructions. Mechanical responses can be collected as keystrokes on the computer, and verbal responses through a microphone on a headset can be recorded for later scoring.
- Most data are collected electronically and can be scored automatically by analysis programs. Feedback can also be immediate, though in the SARA research project analyses were performed later.
- Finally, it saves time. In the SARA project each component skill test took from 5-15 minutes including instructions and tutorials. A computerized testing session including a battery of three or four component skills tasks took about 20 minutes.

A Glimpse into the Future

The SARA project had many findings but none more important this: By using technology to computerize testing, it is possible to reduce the anxiety and boredom inherent in traditional testing settings, give the learner more control, and collect better information.

SARA demonstrates that computerized testing offers a number of advantages over traditional testing models. Computerized Adaptive Testing (CAT) offers even more potential advantages, if its power can be harnessed for the learner, not simply to make more efficient the large-scale data collection efforts of agencies. Wainer (1990) describes adaptive testing as follows:

> The basic notion of an adaptive test is to mimic automatically what a wise examiner would do. Specifically, if an examiner asked a question that turned out to be too difficult for the examinee, the next question asked would be considerably easier. . . . An adaptive test first asks a question in the middle of the prospective ability range. If it is answered correctly, the next question asked is more difficult. If it is incorrectly answered, the next one is easier. This continues until we have established the examinee's proficiency to within some predetermined level of accuracy. (p. 10)

Noncomputerized adaptive tests include Binet's ability tests. However, the cost of trained administrators as well as the inconsistency across examiners make the widespread use of such tests problematic (Hulin, Drasgow, and Parsons 1983). A number of mass administered versions of adaptive tests have been developed including the two-stage, flexi-level, and branching tests (see Lord, 1980 and Weiss 1983). However, paper and pencil adaptive tests pose a number of technical problems, mostly associated with standardizing their administration. With the development of powerful microcomputers, work on noncomputerized, adaptive tests has become all but obsolete.

Computerized adaptive tests in development are more likely to be used to maximize efficiency in assessing group differences by summing over or correcting for individual differences, rather than applying the new technology to the benefit of the individual. Following is a description of how a learner-centered assessment system might operate and how CAT could be used to facilitate its adoption.

Learner-Centered Computer Assessment Systems

A learner-centered computer assessment system will maximize the control, relevance, and value of the assessment information for the examinee or learner (and the instructor when applicable), as well as provide valid information for higher-level users (school administrators, employers, local and state policy makers, public officials, the media, and general public). In the past, psychometric theory and research has been disproportionately concerned with providing information for use by these higher-level users, who in turn make inferences and decisions about and for individuals or programs. The psychometric models used maximize efficiency in assessing group differences by summing over or correcting for individual differences. This practice continues today, even though new technologies have been developed that could be applied to the benefit of the individual.

Even though test packages offer various score scales and individual profile analysis forms in an attempt to link performance levels to instruction, the assumption is that tests must first be highly valid and reliable on a large scale before they can be useful in the classroom. This implies standardized administration, sufficient items to obtain reliable individual scores, extensive investment in item development and consequently security to protect the pool of items or questions.

How CAT Changes Test Administration and Test Setting

Following are some attributes of computerized testing that have the potential to change the culture of testing for the learner. CAT provides test administration and test setting with—

- **Truly Adaptive Tests**. A computerized adaptive test begins with an estimation of the examinee's ability on the trait being measured. If no prior information is known about the examinee, an average ability is assumed. Note that a developmental profile of the person could be stored in the system, to be used to establish an initial ability estimation in the next testing session. Next, items are selected according to an algorithm such that the item difficulty matches the estimated ability of the examinee at that point. After the response to the item is scored (correct, incorrect, or partially correct), a new proficiency level is estimated and a new item chosen from the item pool. The test ends when the target level of precision in estimating the examinee's ability is reached. Several researchers have studied and tested the benefits and problems associated with different algorithms for item selection and stopping rules (Hulin, Drasgow and Parsons 1983; Samejima 1983).

- **Test Length and Reliability**. The research suggests that in many cases, adaptive tests require fewer items to estimate the ability of an examinee at the same reliability as longer paper and pencil tests. Theoretically, by administering items that are focused on the appropriate range of difficulty for an examinee, approximately half the items as a conventional paper and pencil test are needed to achieve approximately the same or better reliability (Lord 1980). This has been confirmed for verbal ability items in a military aptitude test, although improvements in statistical validity shows a less clear-cut advantage (McBride and Martin 1983), in certification exams (Sykes 1991), in achievement tests (Olsen 1990), and in mastery tests (Kingsbury and Weiss 1983). Increased reliability may even be expected because there is less fatigue and more challenge in taking items of the appropriate difficulty.

- **Motivation Issues**. Shorter tests, with more items aimed at a difficulty level one can handle, are assumed to improve motivation to perform well on the test. Although several authors have suggested this result (Stanfel 1996; Wainer 1990), few empirical studies have been done to corroborate the assumption. These same authors, however, have also pointed out that shorter tests may be perceived by some as unfair in not providing them a sufficient opportunity to demonstrate their true ability.

  Other artifactual features of the test setting that may have worked to the detriment of standardized test administration in the past can be and are being altered. The examinee has less probability of making systematic errors in selecting answers on the computer than in marking a score sheet. Most examinees will take approximately the same length of time to complete a test, eliminating perceptions of ability relative to others who work faster or slower. Still, there will also be more time for an individual to work through the items on a test. More privacy can be provided by placing computer terminals in cubicles. Finally, the examinee can trust that human scoring errors are even less likely.

- **Current Applications**. Wainer (1990) uses the metaphor of the Gedanken CAT (GCAT) to describe the test administration site of the future. In it two examinees of different abilities have generally positive experiences with computerized tests that are tailored to their individual differences. Security issues are enhanced, since the setting is a specially designed test site. All examinees are monitored electronically by a benevolent proctor, whose most pressing interest is to detect aberrant answer patterns that may reveal a problem the individual is having with a particular set of test items, although, of course, cheating patterns are also detectable.

- **Research Findings**. Research continues to validate the assumptions that adaptive tests will be quicker to administer, more reliable, and more motivating to the examinee. However, much more needs to be done. The benefits to the individual of a kinder, gentler test setting are considered more as side effects of adaptive testing than central issues of concern. Much more effort has been put into comparing the validity of paper and pencil versus CAT tests than has been put into understanding the reactions of the examinees. (Six of 19 recent empirical studies found in an ERIC database search concerned this latter issue, whereas only two mention the former.)

- **Application to an Examinee-Centered CAT System.** Two issues that are theoretically well-developed but practically ignored by test constructors in applications of CAT systems are feedback and examinee control. Various features of item response theory technology allow the test constructor to detect aberrant response patterns, including special knowledge, cheating, or cultural biases. There are also a variety of opportunities for examinees to tailor the test to fit their own learning needs, as well as providing the best estimate of their abilities, if the learner were provided feedback and permitted limited control. These are issues awaiting future research.

One application to note is a demonstration project in the Waterford School in Provo, Utah (Miller 1985). Waterford integrated CAT systems within a computerized instructional management system, which enables instructors and students to regulate learning development in curriculum areas represented. More ongoing assessment and student-teacher interaction were made available. The report suggests that achievement scores measured in traditional paper and pencil methods also rose after the system was implemented.

The Future of CAT

Sandals (1983) describes two further generations of computer based assessment strategies beyond computerized testing (CT) and computerized-adaptive testing (CAT): continuous measurement (CM) and intelligent measurement (IM). A CM system keeps track of the information collected on an individual, creating a developmental profile. The CM systems he cites are also linked to specific curricula or instructional programs, usually in a mastery learning environment. Lesgold, Ivill-Friel, and Bonar (1989) describe an intelligent testing system consisting of four components: instruction and test planning knowledge, curriculum knowledge, treatment knowledge, and domain expertise. Their system diagnoses the level of knowledge of the learner through an assessment strategy, implements an instructional sequence, and retests the learner to update its model of the learner's knowledge. Experimentation with these systems are ongoing, and practical applications are not far behind. As learners continue to seek more control of their own learning, such systems will find their place in the learning environments of the future.

Distance Learning and Adult Basic Education

John Fleischman

The existing approaches to ABE distance learning are as numerous as the number of agencies providing the services. Unfortunately, very little is known about what works and what doesn't when using distance education with ABE learners. This chapter offers a brief insight into this emerging form of learning, how it is used now, and some information on notable examples and models for distance learning.

At its most fundamental level, distance learning is an instructional delivery system which connects learners with educational resources. Distance learning provides access to learners not enrolled in educational institutions and it can augment the learning opportunities of current students. According to the United States Distance Learning Association, distance education refers to teaching and learning situations in which the instructor and the learner or learners are geographically separated and therefore rely on electronic devices and print materials for instructional delivery. Distance education includes distance teaching—the instructor's role in the process and distance learning—the learner's role in the process.

What Do We Know about Distance Education?

The body of research about distance learning and adult basic education is very limited. In fact, what we know don't know about distance learning in general exceeds what we do know about it. Understanding of the potential of distance learning and ABE must be extrapolated from other efforts at researching the numerous variables.

Moore and Thompson (1990) reviewed a variety of research findings and examined many of the variables of distance learning.

Many other studies have been conducted to explore the comparative effectiveness of distance and traditionally delivered instruction (Eiserman and Williams 1987). The majority of studies concluded that distance-delivered instruction could be as effective as traditional learning if the delivery methods selected were based on appropriateness of the content being delivered, cognitive style of the learner, and background and experience level of the student. Most of the studies concluded that the degree of teacher-learner interaction and the selection of appropriate content were far more critical than the delivery system itself.

Technologies Appropriate for ABE Distance Learning

Adult education programs have been searching for the most effective means of delivering distance education. This goal continues to be elusive and no one technology or methodology has been identified as the most effective delivery system. As noted in ***Power On! New Tools for Teaching and Learning***: "There is no single best model of distance learning. The quality and effectiveness of distance learning are determined by instructional design and technique, the selection of appropriate technologies, and the quality of interaction afforded to learners" (U.S. Congress 1988, p. 27).

The earliest form of adult distance learning took place through correspondence courses. This was the accepted norm until the middle of the 20th century, when instructional radio and television became popular. In the 1970s, professionally designed and produced television series introduced adult learners to videotape programs focused on basic skills improvement, English as a second language, and GED preparation. The major drawback, however, was the lack of a two-way communications channel between teacher and learner.

As cable television and video teleconferencing became more widely available in the 1980s, the possibility of interactive communications became feasible and some two-way distance learning programs evolved. During the 1990s, a broad array of two-way distance learning programs emerged. Current systems now offer an assortment of hardware and communication tools including the following: local area networks, Internet and intranets, telephone-based audioconferencing, facsimile transmission, cable television, videoconferencing with one- or two-way video, fiber optics, satellite, microwave, closed-circuit or low power television.

Today, interest in distance learning for adult education is at an all time high. Many institutions at the state and local level are exploring new ways of reaching adult learners through independent study programs. In recent years, a variety of programs have been established and new programs are being created at an increasing rate.

Approaches to distance learning and adult basic education are as varied as the institutions providing the programs. In some agencies, students use print-based media coupled with postal communication and infrequent meetings. Other efforts focus on learner use of some type of nonprint media that's distributed from a central location. These media could be audio cassettes, videotapes, computer software via laptop computers, or World Wide Web pages delivered via the Internet.

Instructional Television and Video

Early distance learning research done by Chu and Schramm (1975) concluded that instructional television can produce results very similar to more traditional methods of instructional delivery. Other studies (Verduin and Clark 1991) showed that instructional television is just as effective, in terms of learner performance, as face-to-face delivery and is more cost-effective, especially when compared to the expense of rural instructional delivery. The Office of Technology Assessment finds that "the virtual explosion of easily accessible and relatively inexpensive video technologies, in particular VCRs and videotapes, offers exciting new possibilities for using video as a learning and teaching too" (U.S. Congress 1993, p. 208).

One of the most notable examples of instructional television for adult learners is *GED on TV*, a production of Kentucky Educational Television. The program has been distributed nationally since 1982 and is still used today in many state ABE programs. Schwarz (1992) discovered that learner participation with *GED on TV* was a direct correlation to the degree of promotion. State ABE directors also felt that support services can make a difference, but are less crucial than advertising or accessibility.

On a broad scale, the state of Mississippi implemented LEAP (Learn, Earn, and Prosper), a satellite-based education and training program offered at 50 sites across the state. Instruction is provided by tele-teachers and is coupled with instructional support at each of the 50 downlink sites. Courses offered include basic reading, GED preparation, workplace readiness, and life coping skills. One of the greatest challenges of LEAP has been the use of multiple funding sources to provide services.

Many smaller, more localized efforts have been conducted in dozens of states and local communities. Some of these instructional television efforts are operated via cable TV public access or local origination channels. For example, in Sacramento, California, the San Juan Adult School offers programming in a variety of basic education areas. San Juan's Studio E3, in conjunction with the Sacramento Educational Cable Consortium, uses adult vocational students to produce basic skills programming delivered via the public access channel.

A distinct advantage of video for adult learning instruction is the widespread availability of televisions and videocassette recorders. But a significant limitation of videocassettes is the necessity for supplementing the tapes with some type of interactive media. In contrast, video delivered via two-way satellite or desktop videoconference closely approximates the appearance of face-to-face instruction. Based on the popularity and longevity of the various KET video series, television has great potential as a distance education medium.

Computers

Computers can be used to present educational material and perform many other functions in the process of instruction. As a teaching machine and a tool for distance learning, the computer is unparalleled in its ability to provide highly personalized and interactive learning. Although expensive, many efforts at using the computer for ABE distance learning have met with positive response.

The first instructional use of computers with adult learners occurred at the University of Illinois in 1960, the birthplace of PLATO (Programmed Logic for Automatic Teaching Operations). The original PLATO was a versatile computer-assisted instruction (CAI) system in which student terminals were connected by telephone lines to a large mainframe computer. The speed and power of the mainframe computer allowed many users to access the computer at the same time. Rachal (1984) reviewed studies in which PLATO was used in correctional settings or basic skills centers to provide ABE/GED instruction. Many of the studies showed students using PLATO outperformed students using conventional learning methods.

As CAI matured during the 1980s, dozens of different approaches evolved in using computers for distance learning. One common approach has been the mobile lab, most often a converted van or recreational vehicle that is equipped with desktop microcomputers. The lab is typically driven to a locale in the community where residents can board the van and participate in basic skills CAI. Often, the computers are configured in a local area network and software usually consists of one of several major integrated learning systems designed for adult learners.

Through a special California Department of Education effort known as the 5% Performance and Innovation Fund, several adult schools are using laptop computers to serve those who cannot come to the campus (Babayco 1997). Learners use the computers that are loaded with software containing thousands of lessons in reading, writing, math, typing, employability, and life skills. Teachers can monitor progress, review test scores and even take attendance via a modem connection. The learners function independently but meetings with teachers are conducted if the learner is having problems with the program or computer.

In Bloomington, Minnesota, the Mindquest program uses the Internet to offer courses to adult learners. Mindquest permits learners to join online discussions. Lessons are teacher directed and delivered via a proprietary bulletin board system (BBS) and use of Internet-based resources. Participants can earn credit for past experiences. Adults with jobs, family responsibilities, transportation problems, and child care obligations are offered a more flexible program through the use of computers and effective collaborative environment software.

In Santa Ana, California, the California E-mail Project offers adult ESL students a distance learning collaborative environment delivered via the World Wide Web (Gaer 1997). Learners can select from dozens of projects that direct them to contribute their ideas, share information with other learners, and use the Web to gather information for making decisions about their family, community, and work environments.

Computers facilitate self-paced individualized learning. In the CAI mode, they can give students immediate positive reinforcement and feedback. Computers are also a bridge to the future, a future in which e-mail, conferencing, and other means of electronic communication will become commonplace. The greatest potential for effective distance education with adult learners is with the use of microcomputers coupled to high-speed telephone or cable transmission lines. This combination of technologies will allow students to access individualized learning materials and will permit real-time two-way interaction.

Mixed Media

A variety of materials and delivery modes can be used to further the education of adults through distance education. Audio, including radio and audiocassettes, is in wide use in distance education. Audiocassettes provide convenient packages of information that can be used practically anytime and anywhere by busy adults. Radio can be used to reach mass audiences of learners, and the telephone promotes real-time interaction between teachers and students. Print has always been the dominant medium in distance education and will continue to be the most-used form of delivery for many years. Worldwide surveys of distance education show that print is by far the most used medium in the presentation of learning materials (Holmberg 1989).

Examples and Models for Distance Learning

Crossroads Cafe

Crossroads Cafe is a video and print series designed for ESL learners, but is also appropriate for use in school-to-work, workplace literacy, family literacy, and citizenship programs. The series combines drama and comedy in 26 episodes centered around 6 characters and a neighborhood cafe. Crossroads Cafe offers a complete program for teaching English to speakers of other languages, as well as English-speaking persons with low literacy skills. The Crossroads Cafe series depicts adults from diverse cultural backgrounds who face real-life challenges. In addition, each episode is supplemented with documentary-style segments that focuses on cultural and animation that demonstrates the appropriate language used to communicate different types of information.

CNN Interactive Learning Resources

The California Department of Education's Adult Education Unit and Cable News Network (CNN) San Francisco have collaborated to develop a World Wide Web site that offers a resource tool for supporting classroom and distance learning instruction (Fleischman 1997). A major purpose of this website is to make available current news stories to adult learners whose reading levels are not high enough to read and understand standard newspaper articles. A variety of interactive learning activities help reinforce and provide greater understanding of what is presented on the screen.

Each week, a featured story is selected from the CNN San Francisco Bureau and presented in three ways—full text, edited text, and outline format. Using content taken from the featured story, five different interactive educational activities are presented. Learners can respond to vocabulary, multiple choice, sequencing, and comprehension questions. After selecting possible answers users click on a button, have their responses scored, then view the correct answers before moving on to the next activity.

An Internet-based technology known as "streaming" audio allows all text on the screen to be spoken. In this way, even users who have very limited reading skills can understand what is being presented. Learners also have an opportunity to practice their writing by responding to a question about the featured story. Using the keyboard, a student can respond to a statement made or a question asked about the impact of the story. The comments are then sent electronically over the Internet and posted online for all students to read and respond back.

LiteracyLink

LiteracyLink is a significant national initiative that will use the latest in video, online, and computer technology to help adults receive adult basic education and earn high school diplomas or GED certificates. LiteracyLink efforts will produce both video and Web-based materials that will help students prepare for the GED exam. In addition to the creation of two new video series, LiteracyLink will make available extensive online resources for ABE learners and teachers.

Through a diagnostic program known as LitHelper, LiteracyLink will adapt successful adult literacy materials for use in Internet-based GED modules that can be tailored for specific students or local literacy programs. Another component, LitLearner, will offer ABE content in easy-to-use electronic formats, with icon-driven menus and audio instructions. For the literacy and adult education provider, LitTeacher will offer a comprehensive "virtual resource" that will include training in technology issues, technology assistance, a menu of materials on literacy education, and professional development videoconferences.

Barriers to Access

It is important to recognize that many barriers to ABE distance learning still exist. These barriers include lack of financial resources, limited availability of programming that matches the needs of adult learners, inadequate telecommunications infrastructures, and staff inexperience in the use of distance learning technologies.

Distance learning can be costly. In fact, in many situations, distance learning is more expensive to provide than more traditional instruction. Planning and start-up costs can include costly curriculum development, expensive production of learning materials, and extensive staff time for planning delivery. Student instructional tools such as laptop computers and multimedia systems can be very expensive. In addition, ongoing costs can be prohibitive if expensive two-way interactive telecommunications systems are used to connect learners and deliver content.

Although notable examples of new programming are now emerging, a real lack of appropriate curriculum still persists. Effective use of technologies requires high-quality software and programming tailored to the needs of adult learners. Available computer software is inadequate for the demands of literacy programs, and programming for video and other technologies is even more limited (U.S. Congress 1993).

Finally, many adult educators are very uncomfortable in trying new approaches to learning. They believe their traditional methods have worked so why should they try new strategies that aren't proven. Until teachers are comfortable with their redefined role as facilitators over time and space, distance learning will never evolve and be broadly adopted by traditional adult literacy and ABE providers

The Future

Even if funding were not a constraint, the current infrastructure of adult education classrooms and traditional instruction would not provide the solution to the crisis of adult functional illiteracy. Many ABE learners cannot or will not participate in the more "traditional" programs now in place. Ways must be found to extend the range and increase the impact of new modalities for the adult education delivery system.

In the near future, it will be possible to deliver, process, or display video, text, graphics, and audio from a single electronic box. Improvements in digital transmission technologies for both telephones and televisions will increase bandwidth and channel capacity. New hardware technologies will make televisions more like telephones and computers, making vast amounts of video, text, and data available instantly to homes and businesses. All of these trends could promote greater opportunities for adult learning.

These new computer devices coupled with advances in telecommunications networks will allow curriculum to be at times and locations more convenient for adult learners. The promise is clear: new technologies coupled with distance education and a strong degree of teacher-student interaction may evolve into one of most effective methods of meeting the needs of adult learners. However, as our understanding of how to use new tools increases, it must be coupled with an understanding of learner characteristics, needs, and life-role responsibilities.

The Internet and Adult Educators

David Rosen

The study reported in this chapter was funded by the National Institute for Literacy's Leadership Fellows Program. The 1995-1996 study addressed issues related to how adult learners and adult literacy practitioners are using the Internet. The study was designed as cross-sectional and exploratory and included data collected from more than 110 adult educators across the country.

The methodology included an online survey of teachers, administrators, librarians, researchers and other practitioners who subscribed to a range of electronic lists, or "listservs" on adult literacy/basic education/English for speakers of other languages (ESOL); a series of adult learner and teacher focus groups; and interviews with staff development providers who have offered adult literacy teachers Internet training and support.

Are Adult Literacy Practitioners Using the Internet?

The simple answer is yes. Powerful forces in our society are propelling the use of the Internet in schools, businesses and homes: for example, the pervasive advertising of website addresses on television, in newspapers and magazines; lower costs of more powerful computers and modems; a dramatic increase in the number of personal computers in homes; or college students and other young adults away from home who want to communicate with their parents inexpensively by e-mail. Cumulatively, these forces are having a significant and direct impact on educational practices and how many adult literacy practitioners use the Internet.

However, other forces are holding back use of the Internet. Although the cost is dropping, new personal computers are still considerably more expensive than a new television or videocassette recorder. They are beyond the budget of many middle class and poor people, among whom are the majority of adult literacy practitioners. They are also beyond the budgets of many underfunded adult literacy programs. Some programs are challenged by the cost of adding a telephone line, and it is still rare to find a computer, telephone line, and modem in a classroom. Equally important, some teachers are afraid to use electronic technology, especially computers, and worry that they are already so far behind in using technology that they can never catch up.

How Are Adult Literacy Practitioners Using the Internet?

Most of the practitioners who were interviewed were actual Internet users: many were recent ones, and some were more experienced. Their purposes for using the Internet were both personal and professional—

Personal Uses

- **Communication**. E-mail was the most frequently mentioned use of the Internet in all the research conducted, and was usually mentioned by 90% or more of the teachers.

- **Helping Their Children**. As parents they used the Internet for homework and general information research with their children.

- **Research**. Respondents used search engines, databases, library catalogs, and listservs to find weather, travel, legal or other information.

- **Shopping**. Participants used the Internet to purchase airline reservations, investments, or cars.

- **Entertainment and Hobbies**. A few of the many ways teachers entertained themselves using the Internet included meeting people and chatting with them online, visiting humor sites, and virtually touring cities around the world.

- **Employment**. Some teachers used the Internet to look for jobs.

Professional Uses

- **Communicating with Colleagues**. Adult literacy practitioners use e-mail to communicate one-on-one with colleagues; they also subscribe to electronic lists.

- **Online Instruction/Learning/Skills Improvement**. Teachers help adult learners use the Internet for distance learning. One focus group participant—an experienced user—offers an ESOL class by e-mail to students from around the world. Another teaches a reading class using e-mail. Some teachers use "e-zines" (electronic magazines), newspapers, and online cultural sites such as Metropolitan Museum of Art or the Smithsonian Institution.

- **Research and Information**. Some teachers said they use the Internet as a source for classroom ideas and materials, and most practitioners mentioned that they use the Internet as a source of information for a wide variety of personal and professional needs.

- **Professional Development**. Some teachers take classes through electronic bulletin board systems and exchange lesson modules in adult education sections on Internet online services or listservs.

- **Marketing and Disseminating Information**. Practitioners use the Internet for marketing. For example, they publish articles and ideas via Literacy Network of Greater Los Angeles or the Literacy Volunteers of New York Internet publications.

What Internet Features Do Teachers Find Useful?

Among the kinds of websites that practitioners feel are especially useful to them include the following:

- Research sites such as websites for the National Institute for Literacy (NIFL) and the National Center on Adult Literacy (NCAL)

- Curriculum materials sites, for example, the California-based Outreach and Technical Assistance Network (OTAN)

- Sites with software databases

- Sites with interactive online lessons

- Travel sites

- Health/disease networks/support groups

- Local newspaper "customized comics" pages

- Public domain resources (e.g., graphics that can be copied for free)

- Sites with lists of legislators' phone numbers and e-mail addresses

Project participants also mentioned their public library online catalog and noted that sites which included whole documents were more helpful than one without.

Finally, some teachers said that it would be useful to have databases of materials for students, by level, and a filter which could be tailored to search based on one's own interests. They also had several comments about formatting and style: Internet resources should be adaptable to learners' styles (visual, tactile, auditory); Web pages should have large type and bullets; and large graphics should be avoided because they take too long to load.

What Obstacles Did Teachers Find in Using the Internet?

Unfortunately, using the Internet has its difficulties, and project participant identified the following obstacles:

- **Costs**. These include the cost of hardware, software, an Internet service provider as well as training. High Internet service provider hourly costs, some teachers felt, result in their feeling that the "meter is running," that they cannot afford the time to play, to learn.

- **Time**. The Internet requires a big investment of one's time to learn and to use.

- **Hardware and Software Problems**. Some of the problems include hardware that doesn't work together, not having enough memory, and modem problems.

- **Out-of-date Websites and Links**. Some websites, participants complained, were not maintained well and sometimes the addresses of good sites change and their links are not updated.

- **Connectivity Problems**. Phone lines to the server that are often busy; sites that go down; a slow online service; getting bumped off the server; or getting connected, waiting, getting cut off, waiting, and the amount of time this all takes. Because of these problems, some teachers said they find using the Internet in class is risky because it is so unpredictable.

- **Finding Information**. Many teachers felt that the Internet needs to be better organized. As one teacher put it, "I don't know where to go once I'm on, what questions to ask. I understand the organization of libraries and bookstores, but not this." Search time as well as the time it takes to learn how to use searchengines well are problems. Several participants pointed out that the quality of information is uneven and unreliable.

- **Need for Staff Development**. Everyone agreed that there is a tremendous need for Internet (and other technology) staff development. However, some teachers complained that workshops have often been "disastrous—they go too fast, nothing is explained—or they are too basic." One important training need mentioned by several people was learning how to do efficient information searches.

- **Access**. Many teachers mentioned that they don't have regular access to the Internet, especially not in their classrooms; to use e-mail and other features, they must have convenient, regular access.

- **Offensive Materials/Censorship**. Access to inappropriate or offensive materials or, on the other hand, censorship, are problems for libraries and schools, and in some cases, for adult education programs, too.

- **Electronic List Difficulties**. Although these are less critical, many teachers have experienced such annoyances as naively signing onto lists and then getting swamped with messages and not knowing how to unsubscribe.

- **Internet Service Providers**. Knowing which Internet service provider or online service to choose is a problem.

- **Internet Terminology**. Getting mysterious messages such as "login invalid," not knowing what to do to solve the problem(s), and then not knowing the right terms to use when seeking technical assistance are frequent problems.

- **Lack of Administrative Support**. Some administrators don't understand that the hardware is only part of what's needed: teachers also need training and support.

- **The "Black Box Effect."** When there's a technical problem in using the Internet, it is difficult to know where the problem is happening—In the computer's software? Hardware? Local Area Network? In the connection to the server? The server itself? In the browser? At another site's server? And there isn't one person who has the whole picture anymore; one has to be a detective, but this is increasingly more difficult if one can't open "the black box."

- **Technical Support**. Several teachers stated that when something goes wrong and they need help from a "techie," it is difficult to frame the question so that the technology specialist will understand. Combined with the "Black Box Effect" this is very problematic. Some teachers have experienced disdain when asking for technical support. Another problem in getting technical assistance that a teacher identified was not having have a telephone near the computer, so when she needs assistance by telephone, she can't sit next to the screen with the phone in her hand and go step-by-step.

- **Documentation**. Many problems with manuals were identified. Some people like to use them, and some don't, but even those who do like them said they sometimes have difficulty finding the answer to a problem in a manual, especially when they can't accurately name the problem or the manual doesn't have a good index.

- **User Feelings**. Many of these problems and other difficulties result in feelings that further exacerbate teachers' difficulties. One teacher said, "I'm in the same place with my students—frustrated, overwhelmed." Because there is so much to learn and things are happening so fast some said they feel overpowered and wonder how they will ever catch up. Others described their fear of technology and how using it lowers their self-esteem by making them feel intimidated or incompetent.

Staff Development and Training that Make a Difference

Many kinds of training or support have helped practitioners over come the obstacles:

- **Having Clear Purposes for Using the Internet**. Internet training is useful, most teachers agree; but before they enroll they need to have a compelling reason to be on the Internet.

- **Having a "Techno-buddy."** This might include one-to-one mentoring, support from a friend, an online or telephone "tech buddy" or "tech guru"; 65% of the respondents to the online survey mentioned that this helped them.

- **Clear, Easy-to-Use Directions and Instructions**. Participants felt that there are some good teacher training manuals on how to use the Internet; some are online and updated regularly. Some teacher thought that follow-up support after training should include manuals and online help menus. Some teachers suggested short "cheat sheets" that explain what to do.

- **Training**. Many kinds of training—workshops as well as courses—have helped teachers. Teachers found training especially helpful under the following conditions: (1) it is held in an Internet lab offering a combination of overhead presentation and hands-on learning at the computers; (2) it uses the same kind of equipment that participants will use later at work; (3) it takes into account participants' goals; (4) it addresses beginner, intermediate, and advanced levels; and (5) it is customized to participants' needs.

- **Regular Hands-on Practice**. 88% of the respondents in the online survey mentioned that an opportunity to practice using the Internet daily after training is very important.

- **Ongoing Technical Assistance**. Apparently, the ideal is either a two-person support team—one who has human relations skills, and the other who is a "techie"—or one person who has both sets of skills. In any case, these need to be "people who don't treat you as if you're stupid . . . a person you can call who talks to you like a friend," and who provides help in a timely way.

- **Online Help**. The following kinds of online help were found useful to some people: a school district help service; help bubbles; help menus; technicians in online chat rooms to give support; chat rooms with technical questions and answers that are then archived and made keyword searchable.
- **Administrative Support**
- **Time to Learn**

Summary of Findings

At least in some parts of the country there is an extraordinary increase in the use of the Internet by adult literacy/basic education teachers. From the focus groups, in particular, several conclusions can be drawn about how the Internet is being used by these practitioners:

- **To Go "the Way the World Is Going."** Adult education practitioners, like many other Americans, feel the pervasive and persuasive impact that the Internet explosion has had on our culture. As one participant said, "The world is going this way, and so is my family." Or as another said, "It will soon be as common a tool as the telephone, a fact of life." Some, however, said they feel left behind or intimidated by these changes. And at least a couple of people expressed skepticism that these changes can yet be shown to improve the quality of anyone's life.
- **Feelings about Using the Internet**. An important finding is how many strong feelings teachers have about the Internet (and computer technology) in their lives. These feelings—both positive ones such as enthusiasm and empowerment and negative ones such as fear, frustration, and guilt—affect their use of the Internet. Some felt that computers are "invasive," "overpowering," "overwhelming," and that they "lower our self-esteem." Most participants, however, were enthusiastic, if sometimes frustrated users.
- **Purposes for Using the Internet**. These practitioners want to use the Internet for a wide range of personal and professional purposes. Many who are teachers feel that they owe it to their students to prepare them to use the Internet—and computers in general—as tools for survival and success in society. They

use the Internet at home with their children, to communicate with family and friends around the world, for shopping, for entertainment and hobbies, to look for jobs, and to get a variety of information. At work they use the Internet for online instruction; as a source of classroom ideas and materials; to communicate with colleagues (through e-mail and electronic lists); to do research or get information; for professional development (through on-line classes or e-mail); to market their programs; and to publish or disseminate information and student writings.

- **Problems with Using the Internet**. Practitioners experience a huge range of (sometimes overwhelming) problems in using the Internet: lack of administrator support for their using the Internet; lack of easy, regular access; the costs of hardware, software, and an Internet service provider; lack of training and staff development for using technology; the huge amount of time it takes to learn and use the Internet; software and hardware problems; connectivity problems; problems searching for information; inadequate or nonexistent technical support; the terminology; changing website addresses and poor website maintenance; equipment and data security; access to offensive materials/censorship; difficulties using listservs; and difficulty with reading on-screen.

- **Training and Support.** Several teachers pointed out that there are different learning styles that need to be addressed. Some people use manuals; some don't. Some like ongoing help; others, only when they have tried unsuccessfully to solve a problem themselves. Those whose work is to support and encourage practitioners to use the Internet, however, might benefit from seeing the major categories of help that were identified: support from administrators; practitioners having real, clear, and compelling needs and purposes for using the Internet; Internet training; time to learn, and time for daily practice; having clear, easy-to-use directions and documentation; having a "techno-buddy"; getting ongoing technical assistance (after training); and combinations of most or all of the above.

- **Useful Internet Resources**. Participants cited many specific Internet resources that they have found useful, and these were identified earlier in this chapter. Categories of useful sites included the following: curriculum materials for students (in databases, by level); interactive, online lessons; research; databases of information on computer software for adult learners; listservs; and filters which could tailor searches based on the user's interests ("a mind like mine to search for me"). Also noteworthy, particularly because the National Institute for Literacy, through its Regional Hubs, has begun to do this: practitioners said they want more whole documents online.

Recommendations for Enhancing Practitioners' Use of the Internet

Although the number of adult literacy/basic education/ESOL practitioners using the Internet is increasing, several issues must be addressed before there is widespread use in adult education classrooms:

- **Provide Greater Low-Cost Access to the Internet**. The resources for technology in adult literacy education have not kept pace with the interest or demand for Internet access and training. Above all other recommendations is the need for a large public sector investment to provide regular Internet access, training, and support for adult literacy practitioners to use computers and the Internet

- **Use More Training and Support Models**. Teachers need initial training, paid professional time for hands-on practice, ongoing technical support by telephone or in person, and regular and easy access to computers so they can learn, practice, and use these electronic tools. Workshops are not enough. Technical assistance without training is not enough. Training and technical assistance without the time—and equipment—to practice are not enough. All of these elements of a support structure must be in place.

- **Create Good Content**. Practitioners who use the Internet want to find good curriculum materials, lesson plans, articles, interactive online instruction, or activities for learners. Currently, there is relatively little high-quality content.

- **Use the Internet as a Medium for Professional Development**. Providers of staff development for adult literacy educators need to help teachers use the Internet for professional development, for example, to take online courses; use listservs and forums for collegial learning and sharing; and pursue online teacher inquiry projects.

- **Organize Technology Planning at All Levels**. Technology planning is needed at the program level, citywide or regionally, and statewide. This planning needs to describe the purposes, goals, and objectives for using a variety of hardware and software, including access to and use of the Internet.

- **Provide Low-Cost, Easy-to-Use Hardware**. A barrier to teacher (and student) use of the Internet is the high cost and complexity of personal computers. New devices such as Web-TV and network computers may offer low-cost, easy-to-use alternatives and should be explored in the adult literacy classroom and home environment.

Adult Learning, Technology, and Public Policy

Mary Lovell

The concept of instructional technology is changing. Initially, access to technology meant that an instructional program used computers, often for "drill and practice" exercises. Access to current instructional technology now implies the availability of multimedia materials such as CD-ROMs; electronic information resources such as electronic mail and the Internet; and distance learning delivery systems such as television, satellite, or video broadcasts.

It is increasingly important that practitioners use technology to extend access to literacy instruction, to improve the effectiveness of the instruction, and to develop valid outcome measures of its use. Several factors are placing increased demands on the literacy delivery systems. These factors include federal welfare reform legislation, new federal immigrant reform legislation that highlights the need for English language and citizenship instruction, increasing skill requirements necessary for employment, and the need to be familiar with technology as used in the workplace. In addition, state and local service providers often face diminished resources while attempting to meet these needs. All of these factors heighten the value of using technology for increased instruction, staff development and administration effectiveness.

Public Policy Responses

The federal vision for adult basic education learners is to ensure access to high-quality instructional materials and to related information resources through technology applications. *The National Literacy Act of 1991* sets forth a vision for a literate society: "To enhance the literacy and basic skills of adults, to ensure that all adults in the United States acquire the basic skills necessary to function effectively and achieve the greatest possible opportunity in their work and in their lives." Technology can help to achieve this vision. The federal government has developed a number of policy initiatives to expand the use of technology in adult education. These include the following:

National Adult Literacy Act of 1991

The Division of Adult Education and Literacy of the Office of Vocational and Adult Education, within the U.S. Department of Education, administers federal funding available under the Adult Education Act as amended by the National Literacy Act of 1991. This legislation permits the use of federal adult education funds for technology. Under Section 353 of the act, funds for Experimental Demonstration Projects and Teacher Training for special projects and for staff development efforts could include technology projects and staff training in the use of technology.

States are using their "353" funds to support a wide range of technology applications. California, for example, maintains its Outreach and Technical Assistance Network (OTAN) system through federal adult basic education 353 special project funds. This system supports regional staff development centers throughout California and an electronic database on curriculum, assessment, legislation and related literacy issues of interest to teachers which is accessible through the Internet. A literacy project in Lewiston, Pennsylvania, used a 353 grant to develop a curriculum that uses laser disc software in reading classes to enhance the study of social studies, science, literature, and the arts. The laser disc materials supplemented and enhanced the regular literacy curriculum. In Seattle, Washington, a comprehensive manual was written to enable adult literacy students and teachers to use the Internet effectively. The manual discusses how to use e-mail, Usenet newsgroups, listservs, and information resources of interest to educators.

Electronic Information Systems

To make the vision of accessible technology a reality, the U.S. Department of Education is providing technical assistance, information dissemination, and when possible, funding for technology applications and collaborative initiatives. Several electronic databases which are supported by the U.S. Department of Education. The Division of Adult Education and Literacy provides information resources through its homepage on the World Wide Web. Ask-ERIC, another information system funded by the U.S. Department of Education, contains information on adult basic education and literacy from the ERIC Clearinghouse on Adult, Career and

Vocational Education and other ERIC clearinghouses. The National Institute for Literacy supports the Literacy Information and Communication System (LINCS), which is designed to permit access to literacy databases maintained by other organizations. In addition, the National Center for Adult Literacy at the University of Pennsylvania maintains a website on the Internet which provides electronic access to literacy information.

Technical Support Agencies

The Division of Adult Education and Literacy assists State Literacy Resource Centers under the National Literacy Act of 1991. Through these centers, local literacy teachers and administrators receive technical assistance that enables them to improve their literacy programs, including information on the use of technology for instructional purposes. The National Institute for Literacy supports four Regional Hubs that provide technical assistance to literacy service providers, including assistance concerning the use of technology. They serve as the focal point for LINCS activity, training, and technical assistance for a particular region. To assist state and local education agencies in using instructional technology, the U.S. Department of Education established the Regional Technology in Education Consortia (R-TECs) program. The six R-TECs are addressing the need for current information about the effective use of technology for instruction and preservice and staff development, with an emphasis on regional collaboration. The R-TECs identify and make available vital information in a variety of formats on planning for acquiring technology; on best practices, on R&D solutions, and on "cutting edge" applications of technology.

Collaborative Distance Learning Initiatives

In an unprecedented private-public collaborative effort, several states joined with an educational television producer and a textbook publisher to fund development of a distance learning instructional series for English for speakers of other languages adults. In this venture, California, Texas, Florida, New Jersey, New York, and Illinois used a portion of their federal adult literacy special projects funds (353 funds) in working with INTELECOM, a nonprofit organization, and Heinle and Heinle Company, to support development of an instructional program called *Crossroads Cafe*. This distance learning instructional series, comprised of 26 half-hour episodes, is intended to assist adults who have some knowledge of English to improve their English language literacy skills. Aired on many PBS stations, the series can be seen either at home or in a literacy classroom. The series is also available on videotape. Accompanying written materials reinforce concepts presented in each episode.

The U.S. Department of Education's Office of Educational Research and Improvement funded three adult literacy distance learning projects in the summer of 1996 through the Star Schools Program. Each grant is for a period of 5 years. The LiteracyLink Star Schools project is adapting existing adult literacy materials for use online. It is creating a basic *Pre-GED/Workplace Skills* video series. The project is also producing new video and online materials (*GED Skills 2000*) that reflect the new emphases of the revised GED exam. An online diagnostic tool is being produced with helps identify the skill deficiencies of individual learners. In addition, information necessary for writing an Individual Education Plan for participating adults is included.

To enhance the knowledge and professional skills of literacy teachers and service providers, LiteracyLink is establishing a technology-based "virtual" resource center that includes training in technology issues, technical assistance, a rich on-line menu of materials on literacy education, as well as professional development video conference. LiteracyLink's four major partners include the Public Broadcasting Service, the National Center on Adult Literacy of the University of Pennsylvania, Kentucky Educational Television, and the Kentucky Department of Education. Many of LiteracyLink's activities are being implemented through collaboration with the GED Testing Service and software providers. Collaborative efforts extend to the local level, since the project is relying on 25 "innovative sites" across the county to pilot the series.

Another Star Schools project is the Independent Study High School CLASS (Communications. Learning, and Assessment in a Student-centered System Project) Project. During this effort, the University of Nebraska-Lincoln, along with Nebraska Educational Telecommunications, the Nebraska State Department of Education, and the David Sarnoff Research Center, are developing a student-centered communications, learning, and assessment system leading to an accredited high school diploma. The system is intended to be fully accessible online to a national student body. The project is stressing the development of a highly interactive curriculum formatted to and developed especially for electronic delivery. Student access is being provided to digital libraries from national, historical, scientific, and research centers "on demand" over the telecommunications information infrastructure.

The Pacific Adult Literacy Star Schools project is developing three interactive broadcast courses, including the GED by Satellite, a CD-ROM project, closed captioning of programs, descriptive video, teacher inservice training and other system enhancements focused on high school completion, adult literacy, work force readiness and school-to-work transition. All programs are intended for nationwide dissemination. The project gives adults access to challenging instructional offerings that will enable them to obtain a high school diploma or to increase their employment skills. The project is also providing student support services outside of class and broadcast hours.

Central Piedmont Community College (CPCC) in North Carolina, in partnership with the Public Library of Charlotte and Mecklenburg County, Charlotte-Mecklenburg Schools and TRO Learning, Inc. is examining how community-based institutions can use information technologies to expand opportunities for adult lifelong learners. This effort is supported by a 3-year grant from the Field-Initiated Studies Research Grant Program sponsored by the U.S. Department of Education. CPCC is examining the effectiveness of providing basic skills instruction through community networks and the Internet to adults who lack a high school diploma. This project uses *Charlotte's Web*, a nationally recognized and award winning model for community networking developed by the Charlotte Public Library to provide free public access to new technologies, information, education and communication. Developed with private support and a grant from the U.S. Department of Commerce's National Telecommunications and Information Administration, *Charlotte's Web* affords public access computer terminals at more than 75 sites, including all library branches, selected park and recreation centers, homeless shelters, a senior center, a new Transportation Center, and neighborhood housing projects in the Charlotte area.

Staff Development

Teachers working with adults will themselves need to increase their skills in using information resources. More important, they will need to expand their thinking concerning ways in which they can empower adult learners to take responsibility for their learning. To introduce and demonstrate the use of technology to adult literacy teachers and administrators, the Division of Adult Education and Literacy collaborated with the National Center on Adult Literacy, PBS/Adult Learning Service, and WHYY, a PBS television station in Philadelphia, to broadcast four national satellite teleconferences.

It addressed the need for high-quality, accessible, innovative and cost-effective professional development. Simultaneously, it tested and demonstrated the feasibility of distance education for teacher training. Additional teleconferences focused on numeracy, workplace literacy, and family literacy. Each of the teleconferences was interactive by providing a segment for audience questions. Over 25,000 people viewed each of these broadcasts.

In addition to these efforts, the National Center on Adult Literacy is using e-mail and the Internet for staff development in selected sites throughout the country through its Adult Literacy Technology Innovation Network (ALTIN). The ALTIN model for technology implementation in adult literacy involved the establishment of a network of providers connected with each other and the National Center on Adult Literacy's electronic network. Through this network and intensive all-day workshops and hands-on training sessions, especially developed technology implementation modules and related training support materials, teachers are gaining knowledge concerning instructional technology applications.

Final Considerations

These examples of technology applications in adult education represent only a portion of the numerous current technology applications currently being used at the state and local levels. However, these projects demonstrate some of the scope of present technology use. The rise in distance learning and telecommunication technologies is pointing the way to the future, since the prevalence of these delivery strategies is likely to increase.

Looking to the future, the continued use of technology will place several responsibilities on the field. One requirement is for developing new outcome measures that demonstrate the instructional effectiveness of various technology applications. The measures need to be appropriate for the adult learner while simultaneously going beyond the anecdotal descriptions of uses.

Another challenge ongoing challenge for instructors is to provide technology literacy for their adult learners. The idea is to enable all adult learners to feel comfortable using computers, videos, telecommunications, and related technologies as instructional methods. Adult learners need to believe in their capacity to use technology in the classroom, libraries, community settings, and the workplace.

Finally, future use of technology will necessitate an awareness of technology developments, a receptiveness to their possibilities, and continued respect for the instructional needs and dignity of adult learners.

National Adult Education Agencies and Websites

Office of Vocational and Adult Education
U.S. Department of Education
600 Independence Avenue, SW
Washington, DC 20202
phone: 202/205-5451
http://www.ed.gov/offices/OVAE

Employment and Training Administration
U.S. Department of Labor
200 Constitution Avenue, NW
Washington, DC
phone: 800/827-5335
http://www.doleta.gov

ERIC Clearinghouse on Adult, Career, and Vocational Education
Center on Education and Training for Employment
1900 Kenny Road
Columbus, OH 43210-1090
phone: 800/848-4815, ext. 27069
e-mail: ericacve@postbox.acs.ohio-state.edu
http://ericacve.org

National Center for Research in Vocational Education
2030 Addison Street, #1674
Berkeley, CA 94720-1674
phone: 800/762-4093 or 510/642-4004
e-mail: AskNCRVE@ncrve.berkeley.edu
http://vocserve.berkeley.edu/

Outreach and Technical Assistance Network
Sacramento County Office of Education
9738 Lincoln Village Drive
Sacramento, CA 95827-3399
phone: 916/228-2580
fax: 916/228-2563
http://www.otan.dni.us

Regional Technology in Education Consortia
Catherine Moser Connor
U.S. Department of Education
555 New Jersey Avenue, NW, Room 506A
Washington, DC 20208
phone: 202/219-2181
e-mail: cconnor@inet.ed.gov
http://www.ed.gov/technology/sta_reg.html

U.S. Department of Education
600 Independence Avenue, SW
Washington, DC 20202
phone: 202/401-3000
http://www.ed.gov/

National Clearinghouse on Literacy Education
1118 22nd Street, NW
Washington, DC 20037
phone: 202/429-9292
fax: 202/429-9766
http://www.cal.org/ncle

National Center on Adult Literacy—Literacy Online
Graduate School of Education
University of Pennsylvania
3910 Chestnut Street
Philadelphia, PA 1904-3111
phone: 215/898-2100
e-mail: ncal@literacy.upenn.edu
http://www.literacyonline.org

National Institute for Literacy
800 Connecticut Avenue, NW, Suite 200
Washington, DC 20202-7560
phone: 202/632-1500
fax: 202/632-1512
http://www.nifl.gov

Federal Contacts for State and Regional Resource Centers
State Literacy Resource Centers
Frances Littlejohn
U.S. Department of Education
600 Independence Avenue, SW, MES 4419
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